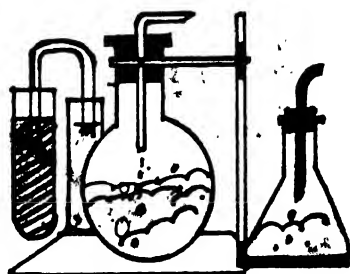
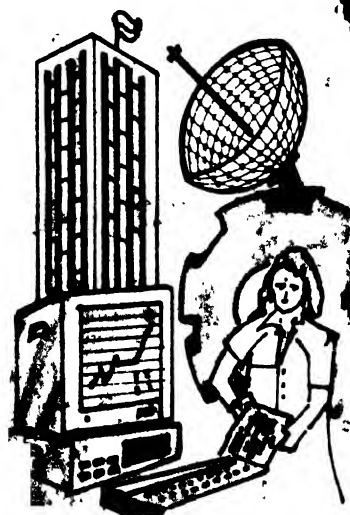


# **WOMEN AND SCIENCE**

**SELECTED  
ESSAYS**



**AITHREYI KRISHNARAJ**



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## ABOUT THE BOOK

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This volume deals with three related spheres—women, work and science. It is concerned not only with what it means to be employed in science establishments, but more importantly, with what science means to women scientists, the significance they have derived from the experience of science education and that of being placed in an environment of scientific work.

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**WOMEN  
AND  
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# WOMEN AND SCIENCE

## SELECTED ESSAYS

Maithreyi Krishnaraj

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## FOREWORD

"Women and Science — Selected Essays" by Dr. Maithreyi Krishnaraj is a valuable contribution in the so far less researched area of women in scientific professions. There have been a number of studies on middle class women's dual role. In fact, educated working women's problems have attracted sociologists for a long time. However, the present study touches a very specific area of women scientists, an area which poses a number of problems. Women workers in a scientific environment are faced with certain common and quite a few specific problems, which Dr. Krishnaraj has attempted to study.

The field of science has been considered "non feminine" and therefore for a long time girls were not encouraged to take science subjects. Science is thought to be "difficult" "too rigorous", "intellectually challenging" and requiring considerable time to master its intricacies. Science being the most advanced branch of knowledge, women were late entrants. Working in a scientific organization implied longer hours of work, primarily working in the company of men and competing with men in the most male dominated field.

Today science is not merely enlightening but is considered to be a socially useful branch of knowledge for development. It stands for rationality and suggests a philosophical perspective, a scientific temper. Consequently the general expectation is that those who have taken science as a subject or those who are working in scientific organizations are expected to be rational, not believing in rituals and adopting scientific practices. However, the behaviour of men scientists have belied such expectations. Quite often great scientists subscribe to beliefs in supernatural spirits and frequently perform religious ceremonies. There appears to be a very convenient compartmentalization in their lives. Are women scientists different? Does working in a scientific organization promote rational behaviour? Does it mean less ritualistic personal life? The data in Krishnaraj's study indicates that no conclusive answers can be arrived at to the above questions.

A very important aspect of women and science is the uneven development of technology and scientific temper in colonial and capitalist economic system. Third world countries have limited resources. Hence, even in India, which is considered to have an advanced industrial technological sector, the scope for absorbing scientists is limited and much less for women scientists. Dr. Krishnaraj has done a commendable job in studying both employed and non-employed women scientists; women who have been trained in advanced science courses as well as women who have taken vocational courses.

Maithreyi Krishnaraj deserves congratulations not only for venturing into a relatively less popular area of research but for establishing interrelationships between women, work and science both through theoretical paradigms and empirical evidences. Prevalence of patriarchal values in the most advanced section of society, compartmentalization of life by women, over-arching obligations to be fulfilled for the familial needs thus prioritizing family role to work role by women scientists whether working or non-working, structural constraints affecting progress of science in a country having colonial legacies are some of the significant dimensions examined in the book.

The study is an arduous process of conceptual battles and dialoguing with women scientists, struggling to understand both the parameters of science and tensions of working women. Undoubtedly, it is a very useful contribution to the discipline of women's studies.

**NEERA DESAI**

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# **FART ONE**

## **THE THEORY**



# 1

## **Study of Women and Science: Need for Alternative Approaches**

Women and science is a problem area which really speaking, spans three related spheres: women, work and science. While it is concerned, in other words, with the problems and issues that generally pertain to educated, employed women there has to be a special focus on science as a profession i.e., the concern has to be not merely what it means to be "employed" for educated women but what it means to be employed in science-establishments, because presumably this would create additional obstacles for women.

On a broader level, what has science meant to women-scientists? What significance have they derived from the experience of science education and of being placed in an environment of scientific work? This is an important question because of the value placed on science in our contemporary world.

Although women, work and science are three distinct areas, there are interconnections. The status of women employed in science, is determined by both: (a) the position of women in society; (b) the nature of science as practiced now within the society. The nature of science in our society and the position of women within the family and society also influence the likely meaning science has for women. Can one assess in some degree the overall status of women in science? In the composite product that overall status comprises, the benefits of employment and education are two important ingredients — In this case, the benefits of science education and work in science. These benefits include both material and non-material indicators. The degree to which these benefits accrue and are enjoyed, depend once again, on both sets of factors: women's own position in society as it has evolved and the way science has developed in that society.

While India displays all the classic features of underdevelopment measured in terms of poverty levels, per capita income and

quality of life indicators, it also boasts of an advanced industrial, technological sector. Indian women also have a dual image. In the aggregate, they have a low status, if judged by overall development indicators such as levels of income, employment, education and health. The first most comprehensive documentation of this became available in the report of the Committee on the Status of Women (1974). Recent statistics have not significantly improved on this, after fifteen years. (Government of India, 1988). Given this general backwardness, the visibility of so many women in professions and in positions of power and prestige strikes many observers as a paradox. This is especially so, as in the economically advanced countries of the West, women are still battling for equal opportunities in the prestige giving professions and in public life.

Since independence the entry of women in science has been significant though not sizeable. We do have a tradition of women in medicine and nursing but women's participation in other scientific fields is recent. Does this mean that many of the constraints that operate against women in science in other countries, do not operate in India?

Some official data from 1961 and 1971 Census (Krishnaraj 1977) suggest that women in occupations requiring higher education face: (a) higher levels of unemployment; (b) earn less on the average than men; (c) are in lower positions relative to men and relative to their own qualifications. This seems to hold good also for science qualified women. There is some preliminary evidence from official data that women in science do not have equal status. The precise causes that bring about this result are matters of guess work which implicate things such as: late entry, interruptions in career, personal difficulties and so on. In general, the bearing of the organizational structure of the work place is left out of the discourse as the assumption is that this would be neutral as between men and women. We need field data to confirm or disprove what official data and commonsense explanations propose as answers to questions such as: (a) what are the rewards and opportunities for women in science; (b) what are the nature of constraints if any; or alternately (c) what support systems are available.

There have been many studies on middle-class educated employed women but neither their subject-matter nor their analytical focus attend to the problem area chosen in this study.

Our subject area, the career status of women in science has not until recently been investigated in any depth.\* What is available to us in the absence of well worked out research, are some national level statistics collected by official agencies in highly aggregate terms.

No doubt, there has been some concern about whether women's employment outside the home alters her status at home as women's economic dependence is rightly perceived as an important ingredient in her subordination. However an empirical verification of improvement in status by recourse to seeking the subjective responses of women is riddled with dangers of oversimplification. Attempts to get at more objective indices such as who controls income or who makes decisions fail to yield unambiguous answers for lack of a sensitive methodological instrument that could measure these. For the study of the complex interaction of women's lives at the place of work and at home, we need a more integrated frame-work than is available so far.

### **Women and Science: Some Special Issues**

The relationship between science and women is not merely one of women employed in a specific occupation. Science has a special place in today's world. It denotes the frontier of modernisation of a society. Its ever expanding boundaries of knowledge, its capacity to control and change the environment, increase productivity and improve the quality of life gives science in contemporary society a pre-eminent position. It is the major, accredited source of knowledge in the present century.

Science also stands for a certain approach to knowledge and not merely a stock of knowledge which goes by the name of "scientific outlook". It implies a certain philosophy, a certain value system. Why should women working in science merit special attention?

The relevance of science to women arises from their being members in human society and secondly from their special role as women. So long as the economy was at a subsistence level, men and women were equally involved in productive activities. Whatever rudimentary science and technology prevailed was

\* Only recently, after 1981, a field study on research organisations was done in Jawaharlal Nehru University for a doctoral dissertation by R.P. Jaiswal. After 1985, there are a couple of new doctoral work in this area, but methodologically, there has not been much departure from the usual run of studies.

equally available to both sexes. As a matter of fact women enjoyed special expertise as subsistence producers, health care specialists in maternal and child care, in child birth, in food processing, in basic crafts etc.\* Hitherto, the traditional knowledge of people was adequate for the performance of the various practical functions which the community needed. A special category of knowledge-producers was not in demand, though it is true that religious knowledge and other "great" knowledge was indeed the preserve of an elite. Simple, pre-literate rural communities while not sharing in the superior culture of the ruling classes did commonly possess two kinds of knowledge: (a) specialised craft/vocational knowledge and skills; (b) such current knowledge of the world as is shared by all members of the same community. Women in history possessed these in equal measure. With changes in occupations or when old occupations faced situations which could no longer be solved within the familiar patterns, the demand for men of knowledge – a scientific community – arose (Znaniecki 1940). The creation of a scientific community came in the wake of industrial-capitalism. For today's Third World countries the impetus has come from the economically advanced countries and the Third World's embroilment in the international economic relations.

In the case of women (just as in the case of all less privileged), to the extent they are in a subordinate position, the impact of changed conditions that necessitates incorporation into new knowledge has a different effect for them. Their exclusion from advanced knowledge takes place as a by-product of their economies moving from subsistence to market based production (Krishnaraj 1984). Kept away from wider participation in the life of the society, women became the ignorant class. They became upholders of tradition when tradition was precisely what militated against their own interests. We have two requirements:

- (1) The need to take science to all the people, not only to a few classes and groups.
- (2) The need to include women particularly for their own liberation and enlightenment as much as for the development of society

Anthropologists record that women contributed to more than 70% of human society's food requirements. See for example, Evelyn Reed, *Problems of Women's Liberation*, Pathfinder Press, New York, 2nd ed 1970

Women need science education and training in scientific methods of inquiry. They also need to participate in the process of generation of that knowledge and its applications.

Sociological studies on employed women have relied heavily on role conflict theories. They present the problematic for women as the difficulty of reconciling a new role, which is employment, with a given social role, that is duties and expectations enjoined on them as caretakers of their families. The discussions do not examine how the roles emerged in the first place and why they are so resistant to change. Role conflict theories have limitations as an explanatory framework for women's labour market status. Some of these limitations spring from the structural-functional theory on which they are based, wherein, macro changes cannot be easily incorporated. Also, these analyses do not lend themselves to the explanation of women's subordination. If men and women play different roles, how does it follow that women are subordinate?

Any empirical study presents essentially a static picture, an image of what is. To understand what is, one has to go beyond the data or rather go behind the data by seeking to see the data in the light of the historical forces of change. Women have entered science as a profession but what were the historical antecedents that made this possible? In what ways were these antecedents inimical or favourable to women? Science has developed, in a particular way; similarly how, why and which women were educated are important to understand why their position at the place of work and in the home is a contradictory one.

A Feminist-Materialist approach views women as a distinct disadvantaged group, apart from other disadvantaged groups and sees the underlying processes that create this disadvantage as inherently of material origin. In India the significant forces to be reckoned are colonialism and capitalism. They changed not only Indian society but had an influence on women's position. Colonialism and capitalism loosened fetters for sections of Indian women but retained some other fetters or altered some of them in form. The existing career status of women in science can be understood as the outcome of the way science has developed and of the way women's position has changed under capitalism and colonialism. The advantage of this approach is that it shifts the focus from individual solutions to the need for systemic changes.

A Feminist-Materialist theory is as yet in its infancy but it offers many valuable insights into women's position. We are very far from evolving a full and bias-free social theory but attempts at building conceptual frameworks are steps in that direction.

The last few decades have seen the efflorescence of feminist scholarship. While Indian scholarship is slowly coming of age in its empirical thrust, much of the theoretical work perforce has come from the West, leading unfortunately to the identification of feminism as a Western ideology. The emergence of feminist consciousness in the last two decades within India and the Third World has led to a new urge to interpret feminist issues in the Third World context. Feminist scholarship and women studies have contributed more to understanding women's issues than mainstream sociological theories.

### **Role Theory: Some Limitations**

The dominant theme in current sociological work on employed women, especially those on educated women relies heavily on the conception of role-conflict. The theoretical basis for this is derived from the general theory of roles and its incorporation into a structural functionalist scheme that postulates specified roles being evoked by particular structures in society. Role theory essentially is articulated in interpersonal and interactional categories drawn from social psychology.

Sarbin's (1954) account of the essentials of role theory is useful as a take off point for a critique. According to Sarbin reciprocal action between persons get organised into roles. The behaviour of persons are ordered actions, emanating from their membership of a society and by virtue of their occupying certain statuses and positions. These positions are collections of rights and duties, designated by the term "role" (e.g., mother, wife, daughter, pupil etc.) The actions of persons are organised around these positions and constitute roles. A person occupying a given position (or status) expects certain actions from certain others who in turn have expectations from him (or her). The variability of role perception, role enactment or taking on the role of another is a function of the self. A role, in other words is maintained by the cognitive structure of the self. When the broader system, that is the qualities that make up the self direct the organism into one set by roles and the narrower system which is comprised of acts and qualities making up role expectations lead to another set not congruent with the first, we have a classic case of role-conflict.



Role theory makes two basic assumptions: (a) roles are learned in the process of social interaction; (b) in interacting with others, people see themselves and others as occupants of particular statuses. There is in this an implicit idea of the self as an evaluative actor. Out of a person's opinion of one's self, a series of identities emerge, which are equal to "positional" labels the actor uses to describe his (or her) own place in the social world.

In the structural theory the concern is with the content, organisation and functions of social statuses and roles. It addresses itself to questions such as: (a) what positions are recognised in the system? (b) what is the content of role prescriptions for those positions? (c) what statuses are included in sub-groups within it or what is the nature of division of labour (e.g., within the sub-system, the school, the division between principal and teacher)? To what extent is there a consensus about roles?

Moving out from the exposition of structures, a functional analysis is then superimposed to explain how a role has consequences for the rest of the system and how each role contributes to the maintenance of the system. Thus, the structural articulation of the roles is placed within the parameters of the structural functional theory, (Heiss 1978) in as much as it deals with that segment of structural-functionalism that operates on a micro level. In the studies on employed women, the function of the family as a structural postulate is accepted so that the concern then shifts to role conflicts for individuals within it.

The social role of a person is conceptualised as belonging to individuals who specialise in certain activities, are members of certain groups, possess qualities needed to participate in it, share common values within the prescribed social circle, are given a social status that prescribes certain rights and certain other expectations from those persons with respect to tasks to be executed.

The problematic posed in this framework for the situation of the educated-employed women is that family role and occupational role place conflicting demands on them so that a sense of distress ensues. This role-conflict is the dilemma and the solution is its dissolution. Men are presumed not have any family versus occupation conflict because they are seen to have only an occupational role. Has anyone studied this aspect? This exclusion is in itself significant.

The presence of role conflict only *indicates a fact and not an explanation*. Further it cannot explain market discrimination against women. The naive answer is that employers are men and "society" (that vague, amorphous something out there) hangs on to rigid sex roles. If women are seen as occupying a domestic role only, their sudden appearance in the market situation may cause displeasure, but why discrimination? There is an extensive documentation of sex role differences that arise because of expectations. It is these expectations that are held to result in bias. If we critically examine this literature, we see the sex role analysis as a circular argument (The National Institution of Education 1979). Sex roles exist, therefore people expect role appropriate behaviour; it is expectations that keep sex roles alive so one should alter "expectations". Why do sex roles exist? Are they universal? Such questions are left unanswered.

The application of this theory to explain lower career success yields the following rather contradictory hypotheses:

- (1) The labour market consists of two non-competing groups (men and women) because of occupational segregation. Women not only get assigned to different jobs; they have also jobs that are lower paid, lower skilled, etc.
- (2) Powerful social norms push women into such educational and vocational choices. They avoid better training that will get them onto better jobs, etc.
- (3) Within a given occupation women have a lower status because of lower career-motivation induced by sex role implementation. Achievement demands aggressiveness and competitiveness but their expressive, nurturing role prohibits them from acquiring these masculine qualities
- (4) Discrimination in the last resort is because of sexist bias.

Theoretically there are many flaws in this approach. Why should different sex roles produce subordination? Sex roles can explain occupational segregation (even that only partially) but it cannot explain why women are paid less. Sex role theory adopts two contradictory positions simultaneously: that women's jobs are ill paid as well as that women get into ill paid jobs because they do not have long-term labour attachment. Why are not better jobs available to women? We keep moving in circles. The problem seems irresolvable because the analysis is totally in

psychological terms with no integration of other social and economic forces. One is simply requested to exercise a heroic flight of imagination to understand how sex role typing in the family extends to other sectors in the society. What is the mechanism that brings this about? We are totally in the dark.

Theory dictates methodology. As the categories used are self and perceptions, attitude-questionnaires which purport to reveal them are the sole means employed. An attitude is an adjustment of the individual towards some selected person, group or institutions. It has therefore motivational properties which involves in addition to a readiness to respond, other ingredients such as belief, disbelief, acceptance, rejection, favour, disfavour, etc. Usually sets of statements are constructed and degrees of favour, disfavour are measured. (Kuppuswamy 1961).

The inference of attitudes is not such an easy, infallible task. The relationship between structural conditions, attitudes and conduct is a complex one. It is simplistic to assume that attitudes are so perfectly malleable that they change as structural conditions change in an unproblematic way or that attitude and conduct are perfectly reciprocal (Warren and Jahoda 1973). The more complex the social structure the less easy it is to build any linear relationship. In sociological theory relating to women, it is assumed that the strength of attitudes to change or resist change is what determines social outcome and is the primary force. What is not realised is that it is not attitudes that prevent change. What attitudes do is to prevent rational discussion of underlying causes, the underlying structure of domination and privilege. Is women's subordination in the labour market the consequence of male-attitude? What structures generate, support that attitude? When we blame the family's attitude or the employed women's attitude as the causative agents for role conflict, we are abstracting from very real structural impediments. If a woman has no one to look after her child while she is away at work and let us say her husband is out of town, it is the absence of child care facilities that crucially determines her predicament, not the attitude of the husband or her own.

Sex role theory's major limitation in our view is its concept of the family as a static and monolithic one. The existing family is cast in the language of functions and roles which ignore not only different type of families but also hierarchies of age and gender within the family. Worse, it cannot explain how the family has

changed through history or how it has emerged in its present form. Though external forces are seen as influencing the family, the functionalist theory sees them changing the roles as a functional necessity.

The architect of the functional school is Parson (1954). He talks of ascription status through membership in a kin unit and achievement of status through one's position in an occupation. According to him, as in U.S., occupations required social mobility, the conjugal unit, with its segregation of sex roles was best adapted, because it ensured that women do not compete with men. As Parson's definition of class status is defined in terms of social evaluations and since sex roles are also defined in normative terms, there is no cognisance of the economic role of the wife. Women's domestic role in the family is only a cultural fact to Parson. He also dismisses the empirical reality of many women engaged in paid work and in occupations. Even when he makes a token recognition of the fact, it does not, in his opinion seriously challenge the husband's occupational role. Marriage confers on the wife a status equal to that of her husband, a pre-supposition that men and women are equal within marriage. However, there is a grudging admission by Parson that women denied of an occupational role cannot demonstrate their competence through competitive occupational achievement like the man.

Subsequently, Parson (1956) shifted his emphasis to socialisation as the major function of the family and talked of expressive roles for women and instrumental roles for men as best adapted for socialisation of children under capitalism when production moved out of the home. With this vanished the earlier mention of structural sources of tension, dysfunctional to the social system. Parson's theory excludes any examination of the source of sexual inequality.

Studies on employed women have applied elements of Parson's theory but in a purely *ad hoc* way. They see the position of men and women within the social structure as defined in terms of social expectations of a person holding a particular role, that in turn social position itself is defined in normative terms. These studies do not pay attention to the *structural* tensions between the occupation system and the kinship system but instead locate these tensions of individual women as resulting from the existence of different sets of *normative* expectations. Consequently the

foundation for a woman's social position is defined in terms of a tension between two roles (occupational and housewife). The housewife role is again cast within two functions only; socialisation of children and emotional fulfilment by providing affectional relationships with other members within the family.

We can now summarise this discussion on role-conflict approaches.\* The limitations of these approaches are:

- (1) The domination of the structural functional problematic has led to divorce the family from an analysis of the forces and relations of production, which are class relations. It also underestimates the importance of both wage labour and domestic labour for women.
- (2) Empirical investigations of "working" women have reduced the contradiction between women's position in the family and female wage labour to a subjective tension between two roles, defined in terms of different normative expectations. No doubt such empirical work has given us valuable information on which women work, what their problems are and so on but they cannot provide any analysis of the distribution of female labour among industries or occupations, nor of the function that normative expectations (i.e., role) serve for the sexual division of labour and of the latter for the mode of reproduction. In other words, they fail to consider the ways in which the labour process structures the organisation of work within a particular mode of production and the relationships between the sexual division of labour and the labour process.

Sex role theory bypasses the complexity of gender relations and its historical evolution. By positing the family as the fundamental biological unit (father-mother-children) we land in a cul-de-sac. Endless seeking after real biological differences through empirical research is a fruitless venture. However, standard texts on sociology adhere to the sex-role propositions of structural functional theories. Discussing the occupational segregation of women and their concentration in a narrow range of occupations,

A good critique is given by Venonica Beechey in her article "Women Production: A Critical Analysis of Some Sociological Theories of Work" in Annette Kuhn and Anne Marie Walpole ed. "Feminism and Materialism", Routledge Kegan and Paul, London: 1978.

Caplow (1970) ascribes this to two things: viewing men and women differently whereby for a man to be subordinate to a woman except in a family-sexual relationship is disgraceful; secondly, to jobs being subjected to a continuous process of evaluation for productivity and efficiency for which women are unprepared, because of their early experience in family life. Caplow declares that men find ego satisfaction in competitive performance. Women find their permanent gratification in affectional relationships or personal characteristics.

There have been in recent years attempts at further sophistication and elaboration of role theory. Mukherjee's (1975) range of variables to build a multidimensional model spells out explicitly what are subsumed under the general rubric of role; he includes variables such as individual resources, range of choices available, rights, privileges, responsibilities as objective measures to tally with other socio-psychological variables. This is useful for describing women's status in a given situation; it cannot provide an explanatory framework.

Oppong's (1981) "Seven Roles" spread out the domestic role into its multivarious components for detailed examination. She talks of parental role, conjugal role, domestic role, kin role, community role, individual role and occupational role. This is more of an inventory where corresponding role behaviours, role expectations are listed together with the activities that go into role behaviour and the resource use they involve. Role expectations have a further catalogue of norms, rules, laws, preferences, assessments, beliefs, representations under three broad headings of prescriptions, values and perceptions. These are in fact detailed "shopping lists" under role behaviour and role expectations. In general, these elaborations complicate rather than explicate by substituting multiple paradigms.

Alternate propositions of segmentation of the labour market are inadequate because they treat the sexual division of labour as an exogenous variable instead of what has to be explained. By concentrating on the supply side of women's labour and its special characteristics this limits the focus to "the decision to work".

### **A Historical Materialist Approach**

A historical materialist analysis can provide better clues for the cause and the retention of sexual division of labour and the attendant consequences for women. Let us look at the question of

how it is that women came to have an unequal and subordinate status in the labour market.

Briefly, the process was somewhat as follows. With industrialisation, traditional crafts were broken down into several simple manual operations with each workman exclusively put in charge of one. [Adam Smith (1904) explains this division of labour with his famous example of the pin. A workman not educated to this business nor acquainted with the use of the machinery employed in it, could scarce, perhaps with his utmost industry, make one pin in a day and certainly not twenty. But in the way in which this business is now carried on, not only the whole work is a peculiar trade, but it is divided into a number of branches of which the greater part are likewise peculiar trades]. These labours were arranged hierarchically. The original craftsmen lost their sophisticated skills. With the dispossession of the craftsmen, their family disintegrated. Women and children were drawn into factory but at a lower wage because women's domestic labour lowers the value of their labour power by producing use values. The husband is paid wages to cover the cost of reproduction. Earlier in the household unit, men and women were both engaged in production. In pre-capitalist pre-industrial societies, the household was simultaneously the site of three processes – production, consumption and reproduction. When production moved out of the home, a new form of family emerged to fulfil the function of reproducing the commodity – labour power – on both generational and day-to-day basis.

The family is involved in the reproduction of social relations of reproduction which in a class society become both class and gender relations. The relationship between production, reproduction and consumption changes historically the very forms of these processes; it transforms the family as well as the sexual division of labour within it. Thus, the sexual division of labour has a material basis and the position of women in employment or their position in the family must be seen as interlinked. This process of change can explain both occupational segregation and lower wages. The major element in social reproduction is the family and the family structure is highly pertinent to the mode of production. The family as the site for reproduction of labour can absorb unwanted/reserve labour. The mode of production is responsible for the demand for special skill categories. Women's labour often becomes "reserve" labour. The education system is

also an agent for reproducing existing social relations. Hence its contradictory effect on women.

A materialist framework and a historical perspective can integrate the family-workplace nexus more successfully than role theories alone. An integrative approach has the advantage of avoiding or bridging multiple-paradigms.

Ritzer's (1980) formulation of a paradigm as a fundamental image of the subject-matter within a science, serves to define what should be studied, what questions should be asked, how they should be asked, what rules should be followed in interpreting the answers. It subsumes, defines, interrelates the exemplars, theories, methods and instruments that exist within it.

An exemplar according to Kuhn (1962) is the sort of element in that constellation, the concrete puzzle situation which when employed as models or examples can replace explicit rules as a basis for the solution of the remaining puzzles.

A possible paradigm could be historical-materialism and the exemplar can be feminism. One can adopt the label "feminist-materialism". Non-materialist sociology vacillates between three alternate paradigms: social facts, social definitions and social behaviour. The Functional theory sees social facts as neatly related and self justificatory. Social Definitional paradigm on the other harps on subjective responses, which is what role-theory predominantly does. Skinner (1959) provides the model for the Social Behaviourist paradigm (stimulus-response theories) wherein there is no scope for creative interventions.

Marx by focussing on wide range of structural phenomena (social facts), often gave priority to external reality but nevertheless gave an important place to social definition i.e., ideology. Following that tradition one can see women's position as both active and historically limited. Within the feminist-materialist paradigm, one can use the key exemplar as "patriarchy". Explanations can then go somewhat further than merely saying that there is sexist bias or that women have dual roles. That both are social facts is not disputed but we have to see them as part of the structure of patriarchy under capitalism. We can this way accommodate class differences, different types of families and qualitative differences in work as related to the mode of production and production relations. We can also bring in the role of the



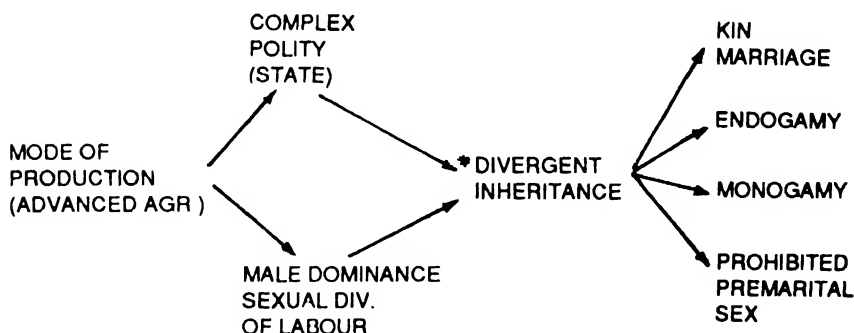
State. Women's position in science is an interesting case of capitalism, colonialism and patriarchy.

### **FEMINIST-MATERIALISM: AN OUTLINE**

#### **Modes of Production and Sexual Division of Labour**

Materialist explanations of women's subordination have come from anthropologists. There are many such attempts but we cite one or two that attempt a synthesis. Jack Goody's (1976) comparative ethnography between Africa and Eurasia isolate and identify the essential pathways that link modes of production, sexual division of labour, transmission of property, marriage and kinship. He sets up correlations between aspects of social organisation in different societies and in different parts of the world and places them in a sequential ordering. He shows how modes of inheritance interacting with mode of production and the State give rise to a hierarchical sexual division of labour and why reproduction of differences is what underpin social hierarchy.

#### **Diagrammatic Representation**



\* Jack Goody (1976:38) coins two terms: homogenous inheritance and divergent devolution in referring to how property and wealth are passed on. Divergent devolution is where "the property an individual disposes is not retained within the unilinear descent group of which he is a member but is distributed to children of both sexes, and hence diffused outside the clan or lineage" whereas under homogeneous inheritance, "a man's property is transmitted only to members of his own clan or lineage who belong to the same sex".

#### **Patriarchy**

Before putting together some current understanding of patriarchy in feminist-materialist literature (of which there is now a considerable amount) it will be useful to discuss first the essential processes within it. We draw upon some of the impor-

tant works in this area: Esenstein (1979); Hartman (1979); Weinbaum (1978); Hirschan (1984); Kuhn-Walpole (1978); Barrett (1980); Brenner-Ramas (1984); Coontz-Henderson (1986).

These works attempt an integration of feminist issues into a materialist discourse. There is no complete theory as yet. As Hartman (1979) says, "It is assumed that the marriage between Marxism and Feminism has already taken place and it only remains to celebrate it". From the Indian point of view, as much of this is derived from advanced capitalist societies, an exact transposition will be foolhardy. We have a large subsistence production sector; we have many elements of pre-capitalist relations in production and in the family. Nevertheless some dramatic changes have come in the wake of capitalism which make the explanations valid in a broad historic context and in its essentials although the exact content and articulation would be different because there are advanced, modern sectors in the Indian economy where the capitalist-patriarchy model becomes relevant.

Much work remains to be done in analysing the way patriarchy would have operated in pre-industrial societies. The current literature on patriarchy mainly refers to advanced capitalist societies though in the last decade literature is emerging from Third World countries too. The essentials of patriarchy can apply in examining the emerging modern sector in India.

In a discussion on patriarchy, there are three processes which need exposition: (a) the process of gender creation; (b) the process of sexual division of labour; (c) the process of reproduction of the labour force and its articulation within the relations of production and reproduction. All these three processes are related and interlinked.

### **Gendering**

The most well worked out theory of sexuality (i.e., the process of gender creation, is found in the group of writers known as "radical" feminists (where the label radical does not refer to an opposition to liberalism) who hold the view that the moving force in history is the oppression of women by men and that the source of that dynamic is male power. This power is expressed in psychanalytic terms and imagery, using Freudian theory. Male power stems from father right and incest taboo and control of female sexuality in the reproduction of this process. Millet (1970) draws upon a vast range of trans-historical, empirical cross cul-

tural evidence in support of this contention but despite this the connection between patriarchy and the economic-political is not very clear. Rubin (1975) similarly retains the dichotomy between the political economy of gender and the political economy of labour. Firestone (1970) likewise deals with universal categories. The question should really be: What is the sexual-political-economy of production?

Mitchell (1975) adopts a particular theoretical position regarding ideology and material base. The distinguishing feature of every social formation is to be found in the particular unity of the levels or instances which compose it: the economic base and the political-ideological superstructure. These levels are different not only because they refer to distinct objects or practices, but also because each of them differs in its capacity to determine the others. The unity they form is a hierarchic relationship between the levels wherein the economic determines in the "last instance". Thus, the political-ideological have a relative autonomy with respect to the economic base — a relative independence but whose parameters are nevertheless fixed by the economic in the last instance. In this formulation, the contention is that ideology has a material existence, is inscribed in a set of social relations, practices and rituals but nevertheless the place of the individual within the concrete practices of ideology is always that of the subject.

It is not the biological family of father-mother-child which constitutes the kinship structure in human society but this biological base is transformed by culture and the culture is patriarchal. Under industrial capitalism, the earlier kinship structure recedes to give way to the nuclear family. The creation of gender is conscious as well as rooted in the unconscious. This explains the paradox that women themselves appear to co-operate in their subordination. "Sexuality is to Feminism what work is to Marxism; that which is most one's own, yet most taken away" (McKinnon 1982). Work is the social process of shaping and transforming the material and social worlds, creating people as social beings, when they create value. It is that activity by which people become who they are. Implicit in feminist theory is that there is a parallel process — the moulding, direction and expression of sexuality organises society into two genders, men and women — which underlie the totality of social relations. Gender is socially constructed, universal and yet specific and historical in its content. Both Marxism and Feminism are theories of power.

They both show how social arrangements of patterned disparity can be internally rational yet unjust. Analysis of society exclusively in class terms ignores the distinctive social experiences of the sexes. The central issues for Feminism are: family, housework, sexuality, reproduction, socialisation and personal life. Gender socialisation is the process by which women internalise a male image of their sexuality, to identify themselves as sexual beings, beings that exists for men. A women acquires and identifies with the status not through physical maturation or inculcation but through the experience of sexuality which is a complex unity of physicality, emotionality, identity and status affirmation. Men control women's sexuality. These are hidden in notions of morality (manifestations are in incest, contraception, abortion, sexual harassment, rape, prostitution etc., where the woman's interest is not made an issue). Women are not in a position to define the norms – these are defined for them. Restrictions on mobility, sexual vulnerability of women in the workplace reiterate this.

### **Sexual Division of Labour**

This operates through several layers. Women's work and men's work are slotted in different spheres, at all levels of society. This results in distinct gender roles and structures their related duties within the family and in society.

Sexual division of labour is universal according to anthropologists but was it always hierarchical? Why and when did it become hierarchical? Sanday (1973) compares over a hundred societies to isolate variables that would go with greater or less autonomy for women. These are, contribution to subsistence; control over produce; organisation of tribal society; requirements of modes of production; emergence of wealth and private property and boundaries between public and private spheres of action. What comes through is that increased sexual stratification appears to occur simultaneously with a general process of social stratification, (Hartman 1979). Male superiority ~~within~~ sexual division of labour was not a universal given but ~~arose as~~ social conditions changed. It is now agreed that sexual division of labour predates capitalism (Leacock 1986). While the original debate is not settled and cannot be settled for paucity of ~~data~~ for the ancient past, what seems certain is that sexual stratification of labour in society occurs along with higher productivity yielding a surplus over subsistence, specialisation of various functions and jobs and increasing complexity of society.

In pre-capitalist societies men controlled the labour of women and children within the household production unit (Coontz and Henderson 1986). (We find this in craft families in India even today). With the emergence of the State and wider ramifications in exchange relations there was a transformation of the direct personal system into a society-based institution using the existing and traditional division of labour by sex and through the principle of hierarchical organisation and control.

Sexual division of labour is reflected in job segregation by sex and in women being responsible for the care of the family. The phrases "working-mothers", "working-women" echo the ideology that women by definition are not paid workers. While sexual division of labour is universal and is found in all societies, its impact on women in pre-capitalist and capitalist societies differs.

Women's position in the family and economy renders the class position highly ambiguous. Where do we place unemployed women, housewives, paid workers, professional workers, wealthy women who do not need work; women who are single parents; female headed households etc.? Weinbaum (1978) has taken objection to Marx's concept of average workers which abstracts from differences due to gender and age. The important questions are: How do the relations of production for different individuals change over time? How do relations between individuals change and how do individuals within these categories relate to each other? Individuals under household production pooled their labour. Now they pool wages. Thus, the economic basis of the household coheres even when production is socialised. With unequal participation in production outside the home, it is also true that the latter reinforce the former. Women becoming wage earners cannot be a solution when they earn less than men and do not get enough to sustain themselves or their families. We see patriarchal ideology at work in India when women earn to collect their own dowries or when they hand over their earnings to husbands or in-laws.

Sexual division of labour is justified as reflecting biology. The truly biological acts for women are pregnancy, childbirth and lactation. If child rearing was a social responsibility and not women's exclusive responsibility and if it were performed under relations free from gender-hierarchy they would be different and non-oppressive. Chodorow (1978) shows how mothering becomes an ideological tool for the economic purposes of

capitalism. Female mothering has the effect of reproducing itself via the creation of gender specific personality structures. "Patriarchy is thus sustained through the sexual division of labour and sexual division of society based on cultural, social and economic usage of woman's body as a vessel of reproduction". Thus, sexual division of labour as it operates under patriarchy influences material production as well as the way we reproduce people.

### **Relations of Reproduction**

In patriarchy as expounded by Marx, where a male head controls the labour of women and children under household production, there is no allowance for any autonomy of content to social relations of production. Women are visualised as inhabiting only capitalist relations of class. Engels (1972) acknowledged that the position of women posed a problem. The sexual division of labour that relegated women to private domestic labour and men to public social labour, Engels associated with male ownership of property and monogamous marriage. He did not raise the question of different procreative function for women of different classes (heirs for the propertied, future labourers for the property less).

"The social relations of human reproduction are class specific. Just as the labour process is situated within a mode of production and its social relations, so is the procreative process. Historically, the procreative process is shaped by relations of control, specifically, here by patriarchy," (Kuhn and Walpole 1978).

Under feudalism, the feudal lord and lady did not do manual work but the peasant's wife worked incessantly. Under capitalism, the wives of capitalists do not have to labour; they on the other hand are required to keep sexual fidelity. Early capitalism drew women and children into labour force; this implied dissolution of patriarchal control in the family; there was also high infant mortality — women's dependence was resecured within the family by State, legislation and union struggles. (This confinement of women to use values and men to exchange values became consistent.)

Women's reproductive function has to be seen in its historic conjuncture. Weights that secured women's subordination shift within different historical conjunctures — exclusion from right to property; decision to labour; control over sexuality, fertility. The terms of entry for women in wage labour in a capitalist economy

is given by pre-existing relations that women have to do domestic labour; so they take on the character of a reserve army. Kuhn and Walpole (1978) regard the family itself as a property relationship which provides the psychic relations for the production of gendered and class subjects for representation of relations of patriarchy and capital.

The foregoing discussion summarised the three processes separately but it is obvious they are interrelated. There are some who broadly subscribing to the idea that gender relations are important do not accept the formulation of patriarchy as a structure. Barrett (1980) for instance, feels that attempts to integrate patriarchy into Marxism leads one to say that it is functional to capitalism or that ultimately it can be reduced to biology. Her own stand does not differ much from explanations of gender-class interactions and women's special oppression and exploitation except that by preference she eschews the technology. Brenner-Ramas (1984) also feel the "dualism" is not useful.

Many of us see however the usefulness of patriarchy as an explanatory and conceptual model. It is a system of male control over a woman's sexuality, fertility and labour. It is a structure that is separate from but interacts with and therefore is conditioned by and in turn conditions the relations of production. As a system it dates back to lineage societies that are prior to the emergence of class society and the formation of the State but its particular mode of manifestation, the relative weights in its different components vary within each historic conjuncture (e.g., dowry deaths and female foeticide and Indian specifics). In fact all the Socialist-Feminists are at pains to argue that it is not a parallel-dual structure hanging loose somewhere. It seems reasonably to accept the view that patriarchy gets embodied in concrete relations and institutions with the family as its pre-eminent site. It is linked to various forms of domestic labour as well as economic relations, concrete ideology and sexual practices.

### **Relevance of Patriarchy to the Indian Situation**

The position of women in science raises several issues:

- (1) What has enabled this class of women to enter science?
- (2) Why do they have a subordinate status in it?
- (3) Is there job segregation and if so why?

- (4) What is there in the mode of production – emergent capitalism – that has modified patriarchal relations in some ways but retained others?
- (5) What in other words is the nature of patriarchy and its connection to the prevailing relations of production/reproduction and the consequences for women?
- (6) How do we interpret career-motivation with patriarchy?

The reference here is with a specific group of women – women from middle-class, engaged in scientific-technical work. What elements of patriarchy operate at this juncture for them, how do they interact with scientific establishment as a specific sector of the labour market? One has to look into the historical antecedents of women's present position in the educational system and in the employment sector to note the influence of colonialism and capitalism as reflected in the growth of the middle-class, the rise of the professions, emancipation movement for women and see the situation of women in science as determined by class as much as by patriarchal relations. Capitalism opened up opportunities, but patriarchy reinforces the subordinate status in family and in employment. State intervention has been a powerful instrument. Opportunities to women came through legal sanctions of equality and state induced planned economy. But the way in which science developed in India adds another dimension. Women in science in India have special problems as a group not only because they are women but also because their own status has particular historical antecedents coupled with the particular mode of development of science under colonial aegies.

As Taylor (1983) says "to see theory as offering an account of underlying processes and mechanisms of society and as providing a sound basis for a more effective planning of social life is to pose a wrong analogy with the natural sciences. Social theorising is a qualitatively different activity because there is always a pre-theoretical understanding which is embodied in the self descriptions on the part of the participants of that society, descriptions of both self and others. The dividing line between ideology and theory tends to be thin. There is also the problem of how one frees one's interpretations from one's own self definitions and values on the one hand and those of the agent on the other.



# REFERENCES

- Barret, Michele (1980): "Women's Oppression Today", London: Vasco Publications.
- Brenner, Johanna and Ramas, Maria (1984): "Rethinking Women's Oppression", *New Left Review*, 144 (March - April).
- Caplow, Theodore (1970): "The Sociology of Work", (Indian Edition), Allahabad: Central Book.
- Chodorow, Nancy (1978): "The Reproduction of Mothering – Psychoanalysis and the Sociology of Gender", Berkeley: California Press.
- Coontz Stephanie and Henderson, Peta (Ed.) (1986): "Women's Work, Men's Property – The Origins of Gender and Class", London: Verso.
- Eisenstein, Zillah (Ed.) (1919): "Capitalist Patriarchy and the Case for Socialist Feminism", New York: Monthly Review Press.
- Engels, Frederick (1972): "The Origin of the Family – Private Property and the State", New York: International Publications.
- Firestone, Shulamith (1970): "The Dialectics of Sex", New York: Bantam Book.
- Goody, Jack (1916): "Production and Reproduction: Comparative Study of the Domestic Domain. Studies in Social Anthropology", Cambridge: Cambridge University Press.
- Government of India, Ministry of Social Welfare (1974): "Towards Equality", *Report of the Committee on the Status of Women in India*.
- Government of India, Dept. of Women and Child Development (1988): *Women in India: A Statistical Profile*: New Delhi.
- Hartman, Heidi (1979): "Capitalism, Patriarchy and Job Segregation by Sex, in Zillah Eisenstein (Ed.), Capitalist Patriarchy and the Case for Socialist Feminism, New York: Monthly Review Press.
- Hartman, Heidi (1979): "The Unhappy Marriage of Marxism and Feminism: Towards a More Progressive Union", *Capitalist and Class* (Summer).
- Hartman, Heidi (1983): "Capitalism and Patriarchy – An Overview in Capitalism and Patriarchy", Women Studies Series, Denmark: Alberg University Press.
- Heiss, Jerold (Ed.) (1979): "Family Roles and Interactions", Chicago, USA: Rand McNally College Publication.
- Hirschen, Renee (Ed.) (1984): "Women and Property – Women as Property", New York: Croom Helm. St. Martin's Press.
- Krishnaraj, Malthreyi (1977): "Employment Pattern of University Educated Women and Its Implications", *Journal of Higher Education*, Vol. 2, No. 3, (Spring).
- Krishnaraj Malthreyi (1984): "Interdependence between Science and Technology and the Social Environment – The Influence of Gender Relations", in *Social Relations of Scientific and Technical Change – Proceedings of a National Seminar*, A. Ahmad (Ed.) New Delhi: National Institute of Science and Technology and Development Studies.
- Kuhn, Annette and Walpole, Anne Marie (Eds.) (1978): "Introduction: Feminism and Materialism", in their book *Feminism and Materialism*, London: Routledge Kegan Paul.
- Kuhn, T.S. (1962): "The Structure of Scientific Revolutions", Chicago, USA: Chicago University Press.
- Kuppuswamy, B. (1961): "An Introduction of Social Psychology", Chapter IX, Bombay: Asia Publishing House.
- Leacock, Eleanor (1986): "Women Power and Authority in Visibility and Power", *Essays on Women in Society Development*, New Delhi: Oxford University Press.

- McKinnon Catherine (1982): "Feminism, Marxism, Method and the State", *Signs* – *Journal of Women in Culture and Society*, Vol. 7, No.3.
- Millet, Kate (1970): "Sexual Politics", New York: Doubleday.
- Mitchell, Juliet (1975): "Psychoanalysis and Feminism", New York: USA Vintage Books.
- Mukherjee, B (1975): "A Multidimensional Conceptualisation of the Status of Women", *Social Change*, Vol. 5, No. 1 and 2, (March-June).
- National Institute of Education (1979): "Sex Role Socialisation and Sex Discrimination – A Synthesis and Critique", Washington: USA.
- Oppong, Christine (1981): "Seven Roles of Women", *Working Paper Population and Labour Policies Programme*, Geneva: ILO.
- Parson, Talcott (1954): "Essays in Sociological Theory", New York: Free Press.
- Parson, Talcott and Bales, R.F. (1956): "Family Socialisation and Interaction Process", London: Routledge and Kegan Paul.
- Ritzer, George (1980): "Sociology – Multiparadigmatic", Boston: USA., Allyn and Bacon Inc.
- Ruben. Gayle (1975): "The Traffic in Women: Notes on the Political Economy of Sex", in Rayna Reiter (Ed.) *Towards An Anthropology of Women*, New York: Monthly Review Press
- Sanday, Peggy (1973). "Towards A Theory of the Status of Women", *American Anthropologist*, Vol. 75.
- Sarabin, Theodore (1954): "Handbook of Social Psychology", Vol.1, Chapter 6, (Ed.) Lindzey Gardner, Cambridge, Massachusetts, USA: Addison, Wesley Publication.
- Skinner, B.F. (1959): "Science and Human Behaviour", New York: Macmillan.
- Smith, Adam (1904): "An Inquiry into the Nature and Causes of the Wealth of Nations", (Ed.) Edwin Cannan, London: Methuen & Co.
- Taylor, Charles (1983): "Social Theory As Practice", Oxford University Press.
- Warren, Neil and Jahoda, Marie (1973): "Attitudes, Selected Readings", 2nd Edition, Hammondsouth. Penguin.
- Weinbaum, Batya (1978): "The Curious Courtship of Women's Liberation and Socialism", Boston, Massachusetts, USA: Southend Press.
- Znaniecki, Florian (1940): "The Social Role of the Man of Knowledge" New York: Columbia University Press.

# 2

## **The Historical Context of Women's Entry into Science**

### **HISTORICAL CONTEXT**

Women's position within the scientific establishment has to be viewed against the historical context of their entry into higher education. Such an examination entails the understanding of the broader material and social forces that were at work and which propelled the demand for women's education and shaped the purposes and goals of women's education at that time. The role played by social reformers in the emancipation of women in the preceding century is well known. However, one must see this endeavour against the changing material conditions that arose during the colonial period. Among the powerful forces that influenced the education system and women's position in it was the rise of the middle-class. The growth of this class is closely linked to the growth of an educated class, whose male members found a serious disjunction between their own position and that of their women. Much of their arguments for women's education spring from this consciousness. However, women's education at the same time became an area of controversy, where ambiguities and contradictions arose because of prevailing patriarchal structures. Our contention is that despite employment of educated women, and new economic forces at work, that ambivalence continues till today. While the rise of capitalism loosened feudal fetters for the upper castes, gender relations moulded by a transformed patriarchy continue to influence the position of women within the home and outside. At another level, the development of science and technology under colonial aegis prevented the growth of a vigorous, self-reliant science and technological infrastructure. This has in turn affected the growth of a scientific attitude. In this process, both men and women are implicated. It is possible that greater involvement in the family might adhere women to rituals that define their caste/sub-group

status but within the confines of this study – as we really do not have comparable data for men – it remains a hypothesis.

Women's participation within the scientific establishment partakes of the ills of the establishment along with the men. Such defects arise from the inadequate development of the economy and the distortions that uneven development carry. This results in our scientific establishment becoming a caricature of the ideal, wherein it is supposed to work in a relatively autonomous fashion, guaranteeing rewards for the meritorious. As such even in this imperfect system there is a gender difference, as revealed by lower career rewards for women and their exclusion from decision-making. These outcomes stem from discrimination whose basis is the sexual division of labour which induces a punitive effect on the career outcome of women, however much individual psychological satisfaction the women might derive. What should be the basis for equality is the fundamental issue here. The historical contours of three developments (a) the emergence of a modern middle-class; (b) the growth of women's education; and (c) the particular pattern of science and technology development indicate how the linkages between these three have shaped the position of women in education and employment and what kind of patriarchal structures continue to operate.

### **THE GROWTH OF THE MIDDLE-CLASS**

The development of capitalism gave birth to the middle-class. Upto the eighteenth century in Europe, social inequality was validated by religious sanction but when the development of capitalism dissolved feudal social relations, the same process diluted the earlier religious sanctions for inequality. This meant the propagation of a belief in "natural rights" i.e., rights due to a man as man and a faith in social mobility. However, it was also accompanied by the birth and extension of new skills leading to an increase in professional groups. Industrialisation produced a more complex division of labour and added to the old proprietors and managers, a vastly expanded hierarchy of managerial, financial, technical and supervisory cadres, not only in the key industries but also in ancillary industries. Further technological advance led to continuous differentiation in education and increased demand for varying degrees of applied and professional skills, remunerated at different levels. It is this group that became the middle-class.

Capitalism created the middle-class and made it an integral part of the social order even though it stood awkwardly between the capitalist and the worker. In pre-capitalist feudal India, it was the trading class that stood between the landed aristocracy on the one side and the serfs, peasants and artisans on the other. The new middle-class had something more than just being an in-between group. They formed a composite, intermediate layer consisting of a wide range of occupational interests but bound together by a common style of living and espousing certain liberal democratic values, a new set of values it sought to impose on the society in which they lived.

India, prior to colonial rule, had artisans which implied a fairly highly developed occupational diversification. The trading classes had their own guilds to regulate prices and protect their rights against encroachment by royalty or the landed gentry. With money economy well advanced in India, the trading classes had their own network of financial institutions, enjoyed power and wealth but were regarded as belonging to an inferior calling. The highly skilled craftsmen had no literary education. Occupational socialisation arose from hereditary callings. The caste system was also tied to property relations in land. The emergence of a new stratified social order based on occupation and education contrasted with the older one based on land ownership, backward technology and household production. The older form of production could not create multiple economic functions because there were fixed status groups.

Into this setup, British rule brought in many radical changes. In the early days of the East India Company, Indians could join British firms as junior partners and side by side with European traders, Indian traders also carried on business. In England, the education system developed to meet the needs of an industrial-capitalistic society; in India, the British evolved a system to suit its requirements of colonial rule. This coupled with the traditional bias against manual labour led to an emphasis on literary, liberal education and its virtual monopoly by the upper castes of Hindu society. This new class of Indians sought position and influence in the civil service. Neither mass education, nor economic development followed. While some kind of a business class did emerge, it was outstripped by the literate classes. That this new intelligentsia was the creation of British influence is also mentioned by Mukherjee (1958).

Mishra (1961) identifies the middle-class as being a conglomerate of the following categories (Dube 1982):

- (1) A body of merchants, agents, proprietors of trading firms excluding those at the top;
- (2) Salaried executives;
- (3) Salaried officers from a wide range of institutions;
- (4) Civil servants;
- (5) Members of professions;
- (6) Upper and middle range of writers, journalists, musicians, artists etc.;
- (7) Petty shopkeepers.

Broadly the stages in the growth of the middle-class coincide with the developmental stages of British rule. Originally the East India Company was interested in preserving India's traditional artisan production because it bought from them to resell in Britain. With the strengthening of industrial capitalism in England, it sought expansion for its own exports. With the ending of Company rule, Indian artisans suffered a massive decline (Sen 1982). With the flow of British capital and the growth of British bureaucracy new changes came into effect. British rule elevated the Indian bourgeoisie as against the older landed classes. The rise of new colonial cities and centralised administration replaced the customary services in village communities between (classes) castes. Private property in land created by British legislation led to sale of land, growth of moneylending and civil suits. With the help of the Indian bourgeoisie, the educated classes were successful contenders for power, in an officialdom not rooted in land, but generated by alien rule. Such unprecedented occupational mobility was new. This had a deep impact on many facets of life, including the status of women.

Misra (1961) gives some idea of the scale of increase in the ranks of the professional classes. There was an enormous increase in Government servants because of specialisation of functions, new revenue and rent laws and the founding of new courts of law and expansion in the police force. In 1857 there were 900 covenanted civil servants, but not a single Indian; among the 5928 uncovenanted, half were Indian but by 1901 the total number of Indians in government service exceeded 25,000 ! The brahmins held most of the posts.

Between 1881-1901, there was a rapid rise in the number of lawyers due to increase in civil suits: from 815 in 1864 to 1317 in

1893. By 1921, there were 984 advocates, 1776 vakils. The number of students in medicine increased from 1396 in 1911-12 to 4065 in 1921 in eight colleges; the number of the teaching colleges increased from 12 to 20 and students in them from 500 to 1250; similarly civil engineers increased from 1187 to 1443.

Side by side higher education developed (Government of India 1886-1904)

<i>Year</i>	<i>Colleges</i>	<i>Students</i>
1873	55	4,499
1881	85	7,582
1886	110	10,538
1893	156	18,571

The educated middle-class was drawn from upper castes who also held land. These developments did produce conflicts. For instance orthodox Hindu society resisted liberalism – they were the revivalists – with respect to many aspects of Hindu society. The new economic developments saw the growth of peasant working class movements.

The liberals began to evaluate their society and part of this re-examination was the deep concern with the position of women in Hindu society and a major plank in the agenda of reform was the education of women.

### **GROWTH AND CONTEXT OF WOMEN'S EDUCATION**

Even though the social position and education of women had attracted the attention of social reformers earlier, the debate over the question acquired a particular intensity towards the end of the 19th century. Karuna Ahmad (1984) lists books that came out during this period and by 1920 education of women became a public issue, coinciding with the period of social and political awakening. Around this period a number of legislative enactments were also made.

In 1929 the Hortog Committee stated that priority should be given to women's education. Educated women also began to take interest. In this movement, a prominent part was played by the missionaries.

### **Social Reformers and Government**

There are some broad stages in the development of higher education for women. Some colleges were founded in different

parts of British India (Calcutta and Madras – 1782 founded by Warren Hastings; Sanskrit College, Banares – 1791; Sanskrit College, Calcutta – 1817; Agra – 1823; Delhi – 1830; Deccan College, Poona – 1821; Elphinstone in Bombay – 1827; Christian College, Madras – 1837, Presidency College, Madras – 1846).

<i>Year</i>	<i>Special Institutions</i>	<i>Girls (Secondary Level)</i>
1881-82	28	1581
1901-02	67	4984

But it is Wood's Despatch of 1854 which is the first major pronouncement on female education. In 1857 came the three universities in the Presidencies and others came up after 1920. By 1947 India had 24 universities. Women's education began with a slow start around 1880 when special institutions for girls were set up. The number of such institutions at primary and secondary level increased (Government of Maharashtra 1958). But till 1907 the bulk of the effort for promoting girls' education came from missionaries. It was only after 1920 that a number of resolutions were passed by Government and Women's Organisation (AIWC in 1927; Bengal League in 1927). During 1887-1897 missionaries set up 4 women's colleges; during 1911-1935, 25 had come up. Between 1935-1947, the number of women's colleges totalled 37. They were run by Christian missionaries, Hindu reform organisations. There were also women in co-educational institutions. To sum up: (a) much of the improvement in female education was due to private effort; (b) after 1920 women's organisations played an important part; (c) progress in higher education was not matched by eradication of illiteracy.

The demand for education for women was spurred by the felt need for reform of Indian society. Education of women was seen as an instrument in this. The rise of a new class, drawn from upper castes, occupying new professions and in contact with the British generated a cultural gap between men and their women folk at home. The imbibing of liberal values by these men led them to question the social evils that subjugated women. Education was expected to release them from the stranglehold of custom.

### **Ideas on Goals of Women's Education**

While the impetus to women's education among the middle-classes came from these influences, the ideas they had on the



content and aims of women's education tell us something about the "limits" to such liberation. They were interested in improving the efficiency of the women within the traditional roles. The pronouncements on co-education, curriculum, goals etc., point to their limited view of the role of education for women. Christian missionaries who pioneered girls education said:

"We should aim therefore at demonstrating to the people that the girls who have been to school become superior housewives and mothers, that what they learn is of real value to them in the home and above all that their moral character is improved and strengthened." [Sridevi (1958) quoting from Report of the World Missionary Conference, 1910].

Mazumdar (1975) asserted that the leaders of the women's movement differed radically from the earlier social reformers in that while the women leaders stressed the need for an enlarged role for women, the social reformers had talked of efficiency in their family roles. The freedom movement altered the perspective on women's education. "When Gandhi demanded equal political, legal rights for women he did not justify it on grounds of social justice for women alone as an end in itself but as a necessity and as a means of achieving social transformation and the solution of social conflicts which was the biggest goal of the freedom movement (Mazumdar 1977).

The most significant contradictions emerged in the discussions on curriculum for girls, the majority (usually men) favouring a different curriculum for girls.

Hannah Sen said, "Whether women marry or follow other pursuits, on them will devolve the task of running a home. Indeed, education for beauty, health and economy must be available to all women and all men for men share with women, the responsibility of producing healthy children of providing them with the right atmosphere and of guiding them into a life of self-controlled freedom." Hansa Mehta,\* likewise stressed the larger role for women though they would still have to take care of the home. "Though training in domestic science may form an essential part of the large majority of girls, it would be well to remember that a women's usefulness is not circumscribed by the limited demands of her husband and children."

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\* Cf Special Committee on Differentiation of Curricula set up in 1954.

The All India Women's Conference in 1927, declared that while girls' education should be equal to boys, education for girls should equip them for home and married life as the majority of girls will get married. Women who receive higher education would be useful in advising and planning women's education.

There were others who were far more radical such as Miss K. Myers, President of Queen Mary's College, Madras. Speaking at the All India Education Conference, 1946, she said:

"No one wants to pen a Madam Curie between the kitchen and the parlour or would expect a Senior Wrangler to remain absorbed in estimates of fish or washing. Spacious minds should move within a spacious environment."

After Independence the many different committees on women's education held on to either a different role for women than that of men and hence a different curriculum or the more progressive among them argued for an "enlarged role".

The University Education Commission (1948-49 p. 392) extolled at length on the mother's influence:

"In every country, no matter how far the liberation of women has gone, husbands and wives play different parts. In general, the man provides the income and the women maintains the home."

The Secondary Education Commission (1952-53) said:

"While no distinction need be made between education imparted to boys and girls, special facilities for the study of home sciences should be made available in all girls' schools and in mixed schools."

In 1954, a Special Committee set up by the Government of India on differentiation of curricula, recommended home science at middle level for both boys and girls. It favoured diversification.

The Education Commission (1966 p.135), however stressed the role of the mother:

"The significance of the education of girls cannot be overemphasized. For full development of our human resources, the improvement of our homes, and for moulding the character of children, during impressionable years of infancy.... Education of girls can reduce fertility...."

But adds later, "As at present women students should have free access to courses in arts, science and technology. The more academic minded girls should have opportunities for a career." It also recommended vocational courses in professional fields where "women's services" are required (teaching, social work, nursing, health etc.) thereby accepting sex segregated jobs.

Thus, the idea of "the educated mother and companionable wife", persists with a little addition of citizenship and occasional employment for some. This was also the view of reformers like Karve. Even though the 1954 Commission bravely talked of men and women sharing responsibility at home and outside, there continued the emphasis on women's family role. We see here how the sexual division of labour is unquestioned. A woman is to be educated as a mother, as a wife, as a citizen, but not really for herself. Even if an occasional woman embarked on employment, she was supposed to manage it somehow. Dongerkerry (1967) says: "The greatest profession of women should be that of mothers, though it should not restrict them."

Nobody talks of fathers and their responsibilities. Secondly, nobody says anything about how conflicts could be avoided if women manage home and career. It is clear that right upto the late sixties, our educationists have thought of women only as home makers primarily with a concessional expansion of sphere.

As Karuna Ahmad (1979) says, the education system while emphasizing the home making role of women nevertheless makes no allowance for it in terms of hours, schedules, ethos, etc. Why is it repeatedly emphasized that "girls marry". Do not boys marry? It implies of course that marriage is their sole career. Even a UNESCO report says: If girls perform household chores from an early age, education should equip them for it. The goals of women's education pursued hitherto hang strongly around the sexual division of labour and exclude ideas of women's equality in employment.

Two studies [Shukla (1982) and Papanek] confirm our view that education confers social mobility through higher social status but with a built-in gender bias. According to Shukla (1982) women of a given social class register the same kind of advance which men of the next lower stratum have attained; within a given social and economic grouping of women, women have a higher educational level than men.

S.C. Goel (1977) calculating social returns from education show that they are lower all along the line than private returns for all but Tilak (1980) saw less returns for women on all counts.

	<i>Social Returns Percentage</i>	<i>Private Returns Percentage</i>
Primary over Illiterates	10.1	10.4
Middle over Primary	9.9	10.1
Secondary over Middle	5.1	6.0
B.A./B.Sc. over Secondary	4.8	6.4
M.A./M.Sc. over B.A./B.Sc.	8.6	11.7

Vocationalisation at secondary or post secondary level serves lower middle-class but the demand for higher education comes from higher income groups.

Tilak saw that illiterate and less educated women concentrated in unskilled, wage earning occupations but a larger percentage of men with no or less education were in clerical and skilled jobs. On the other hand women graduates cluster in professional or administrative jobs whereas men with same level of education are found in both clerical and professional occupations.

The NSS 32nd Round bring out the contrasts between education-employment relation for men and women.

<i>Educational Level</i>	<i>Percentage Share in Labour Force</i>		<i>Percentage Labour Force Participation</i>		<i>Percentage Unemployment Rate</i>	
	<i>Women</i>	<i>Men</i>	<i>Women</i>	<i>Men</i>	<i>Women</i>	<i>Men</i>
Illiterate	25.83	22.09	23.18	60.39	7.88	2.11
Literate, upto Middle School	35.49	50.85	9.08	53.84	25.65	6.57
Secondary	25.71	18.38	22.26	72.27	42.37	10.18
Graduate and above	12.97	8.68	43.64	88.02	35.92	9.37
Total	100.00	100.00	17.06	60.12	17.76	6.48

These characteristics apply to women scientists (Dube 1977). They come from well educated, higher income groups. Higher education is a mark of status regardless of its returns. But because economic conditions have changed, social class

maintenance requires them to earn; given the structure of the labour market, they get only lower positions. The concept of equality with men in the occupation does not concern them because their class status is derived from the men of their family. Their participation in employment needs the family's support and they cannot repudiate their subordination or sexual division of labour for fear of losing that support.

Women from the middle-classes have gained only partially from education because the goals of women's education never included equality and never questioned the sexual division of labour, which is an underlying basis of patriarchy.

### **THE GROWTH OF SCIENCE AND TECHNOLOGY IN INDIA — THE DEVELOPMENTAL CONTEXT**

Science is a characteristic combination of the rational and the empirical with systematisation of hypotheses about the external universe which stand the test of controlled experiment. In this form, it arose as a distinct activity in 17th century Europe. In the development of science, basic research, applied research and technology became an interrelated system feeding upon each other and the wider society at several levels. At different periods of growth, it was conditioned by factors inherent in the environment social process.

Bernal (1969) has shown how the needs of industry in Western Europe under capitalist development propelled scientific advance in a particular way. Our model of scientists "discovering" something and then industry applying it is not how it happened. Many of the early problems in science arise out of technical difficulties faced by the nascent textile industry in Britain. Therefore, a universalistic approach to science and technology is not useful. The role of value in this context is specific to the people and society concerned. According to Ramakrishna Mukherjee (1977), "In the present state of our knowledge in theory and action, we cannot speak of one or the only value in scientific and technological development. It has to be a matter of diagnosis in a place-time object bound field in which there is diversity of possible value significance."

The Weberian hypothesis representing science as "rationality" and "rationality" as the epitome of capitalism denotes science as an abstraction, ignoring the inner interrelations between this "rationality" and the fundamental interest of capital. The essential characteristic of capitalist mode of produc-

tion is that it makes science a productive force distinct from labour and presses it into the service of capital. In other words, the social consequences of science and technology are due not to the advance of science and technology *per se* but because of the specific form of science and technology arising from the socio-economic factors.

Therefore, to talk of science in the abstract is meaningless. How it develops, what form it takes depend on the concrete situation. Each society has its own ways of knowing and making things, accumulated from generation to generation and expressed in the every day language of the people. The difference between this and "modern science" is the language used i.e., a specially accepted, symbolic system. Because this symbolic language is common to modern science, it obscures the historical-sociological co-ordinates within which science takes shape.

Sociological analyses commonly propose a universal-evolutionary pattern of development of science in a hierarchic way, i.e., from a "traditional" to "modern" or from "less developed" to "more advanced" on the one hand or alternately the components of science and technology are identified primarily through their abstract principles. For an objective analysis of science and technological revolution, we have to take note of the historicity of the cultural and material forces and their role in the process of the scientific revolution.

According to Merton, the factors determining the course and content of scientific activity is the norm governing the internal social structure of science whereas for Marx, it was the underlying economic forces. While these "norms" are basic to the scientific procedure (being objective/regard for facts/verification etc.), this does not contradict the contention that wider socio-economic conditions shape scientific activity [Barnes (1972), Barber (1952)]. Are the objective conditions conducive to the full development of science and technology and to what extent do these affect the compliance of the practitioners to those "norms"?

Dedljer (1967) argues that the developing countries of today never had any "science" or scientific outlook. There is in these countries less awareness of the importance of science. The obstacles, according to this view, are "cultural." In other words, they suffer from an inability to develop the scientific outlook, the belief in the value of systematic and persistent observation as a means of discovering the coherence and determinants of the

natural order of existence. "Such indigenous science as had once existed long since died away and no trace of it is active." These are sweeping statements, and such culture-protagonists dismiss the remarkable developments India had made in medicine, astronomy and mathematics as inconsequential. Such authors see a special endowment in "Western" culture that uniquely befits them for scientific enterprise. Degler (1961) argues that the failure to develop enough science and technology and to make effective use of it is caused by the failure to imbibe the scientific tradition, which in turn leads to inadequate appreciation of research by industry and agriculture and by government bureaucracy. These institutions also lack this "spirit" and hence fail to provide a supportive environment. According to this view, the less developed countries have no "scientific community" as an organised group, with a developed system of beliefs and institutions for internal communication as well as for communication with other social groups. In advanced countries, it is argued, the scientific community is large enough to permit this process. The thesis here is that the cultivation of science is a collective undertaking whose success depends on the scientific community as a crucial part of its social structure. Embree (1974) puts it even more categorically. Indian civilisation is a closed system and Western science is not compatible within. He seems to forget that Karma, Dharma, etc., common to Buddhist countries as in Japan did not prevent them from adapting to modern technology (Goslin 1974).

To sum up these arguments, India lacks a scientific community without which science cannot advance; it lacks a scientific community because our "traditional" society is not conducive to imbibing scientific outlook.

While granting the absence of both, we question however the causes. The causes lie more in the nature of economic development (Ramasubban 1971) and is not a unique deficiency in culture. The development of science in India during the colonial period can be seen as forming three phases: (a) In the first phase, the East India Company trained officers of the company to study the flora, fauna of the country. There were meteorological, geological and geographical surveys. These scientific interests were peripheral to the trading and commercial interests of the company and were used for consolidating the company's domination. (b) The second phase, relates to the takeover of India under the British Crown. It also marked the emergence of industrial

capitalism. There was some systematic investigations in some fields but these were totally geared to the expansion and economic penetration of the interior regions and for stimulating raw material exports (jute, cotton, tea, etc.), but most of the research institutions were manned by British personnel. While the development of the railways and public works required a number of technically qualified and skilled manpower, Indians were trained only for lower levels. In fact much of engineering related to the military needs of the empire and the term "civil engineering" to refer to construction arose in this context. These activities hardly led to the establishment of a broad based science and technology structure to meet the needs of India's national development. (c) In the third place, Britain's position as a major industrial power had already declined in Europe and this posed challenges to British interests in India. Some effort was therefore made to promote limited agricultural research to increase agricultural productivity that would stimulate export of raw materials and increase the supply of foodgrains for defence requirements. During this period, there was a vigorous Swadeshi movement that clamoured for the promotion of science education; there were notable nationalist efforts to open science classes and provide science teaching in Indian languages but with the economy not expanding enough to stimulate demand for trained science and technological persons, the movement did not become effective in creating a sound foundation for science in India.

Agriculture, a few industries and medicine were the only areas where research centres were set up. These were directly linked to the needs of the colonial power. The agricultural research centres set up in early 20th century brought in no transformation of Indian agriculture. In industry, British encouragement was only in those industries where Britain wished to keep other rival European powers out.

The history of science education follows the logic of this development outlined briefly above (Rahman *et. al.*, 1973). The East India Company in 1813 initiated a move to induct Western education in India as part of its educational policy but it was geared to meeting the needs of lower functionaries in its expanding bureaucracy and policies. The first vocational school was started by the Portuguese in Goa in 1575. The British opened the first science college in 1820 but even upto 1893 there were only 4 engineering and medical colleges. The British Government in response to pleas for scientific studies to develop the resources of



the country had declared that the industrial surveys carried out were not important enough to warrant expenditure on technical education (Nanda 1977). The technical schools that survived were those that guaranteed jobs in the P.W.D., surveying, jute, textiles and railways and British ships. These were very limited gains that did little to stimulate the general growth of science and technology. Even the industrial schools that trained lower level technicians were of poor quality. Thus, although the first technical institutes were set up a century ago the growth of education in science and technology in India remained static till Independence.

The post-Independent period is a saga of phenomenal growth in science and technology education. Today we have over 4000 graduate and post-graduate colleges of which more than half offer science (Nanda 1977), and our expenditure of science and technology has gone up from 0.21 per cent GNP to 0.43 per cent.

However, the development strategy after Independence has relied heavily on foreign collaboration and indiscriminate import of technology. Many research institutions function in an *ad hoc* manner, outside the planning process. In the planning of research there is heavy reliance on advanced countries because they control and are in possession of 90 per cent of the latest and advanced technologies (Rahman 1977).

This has two effects: (a) the prevention of a self-reliant economy and a self-reliant scientific structure; (b) the compartmentalisation of scientific culture and the rest of society, as the insufficient integration of science in society continues to be perpetuated by neo colonial impact. This disastrous effect can also be measured in terms of the inability of the country to absorb its own highly trained persons, who are attracted to advanced countries both because of better incentives as well as the orientation imbibed in their training which emphasizes only the instrumental value of science training.\*

This migration of trained persons is also called "reverse transfer of technology". Its scale and the cost to the developing countries as against the benefit to the advanced countries has been estimated in an UNCTAD study Dependent Development — Cost to the Nation" reported in *Technical Manpower*, Vol. XVII, No. 5, May 1975. Between 1961-70, inflow of 39,071 scientists, 14,545 medical doctors and 53,616 scientific personnel to the U.S. from the developing countries meant a net gain to the U.S. of 3662 million U.S. dollars of which India alone contributed 874.5 million dollars.

Despite the scale of expansion of R & D and of science education in the country, it has not led to an independent self-reliant economy which could link well with the growth of scientific community.

The insufficient imbibing of the universalistic value system of science is not the only reason for the insufficient growth of science and the particular organisation of science in India but the more important reason is colonial development which did not gear science development to national priorities. Post-Independent India's development model continues to rely heavily on external support so that a true national resurgence to bring about a self-reliant, egalitarian development has not emerged.

Indian scientists in general suffer from being members of a faulted system, where there is no (a) well developed scientific community, (b) where the "reward" system does not operate efficiently due to organisational defects.

The position of women within this enterprise has a double disadvantage—first as members of this system and therefore sharing its ill effects and secondly as women, deriving their status from patriarchal structures. Traditions are after all also products of material circumstances and the pattern of relationships between the dominant and dominated classes; lack of scientific temper by itself is not the cause of underdevelopment because a behavioural trait cannot explain the rise or fall of whole groups of people. While Krishna Kumar (1984) refers to class relations, we extend the analysis to gender relations.

## **Conclusions**

A Feminist-Materialist framework explains the subordination of women through the conceptual model of patriarchy. Patriarchy is a system of male control over women and has a structural form that is separate from but interacts with and is conditioned by relations of production and mode of production. Patriarchal relations also control relations of reproduction—as a result of which gender relations take particular forms.

In India, the growth of capitalism under colonial conditions led to the growth of a middle-class with a particular nexus between education and employment. This loosened the controls over women in the family for this class and education for women was pushed as a means of improving their value to the family. Developments after Independence has pushed educated women

into employment. The expansion in education-related jobs and growth in the number of scientific establishments and State guarantee of formal gender equality aided this process.

Two process however restrict their benefits to women. Science grew in India in a way that has prevented the emergence of a "scientific community." Education for women while giving opportunities to them never made equality of the sexes a goal but strove only to improve the position of women within the family retaining the basic structure of patriarchy: the sexual division of labour and control over female sexuality and fertility. Development of capitalism opened new opportunities for employment but while the relations of production changed, the relations of reproduction under patriarchy ensured that the terms of entry for women in wage labour continue to be what they were, namely that women have to do domestic labour. Further, the family itself provides the psychic relations for the production of "gendered" subjects.

"It seems doubtful however if the symmetric family will develop in the near future in cultural settings such as India because apart from cultural attitudes to the wife-mother role women themselves in the prevailing system of arranged marriage tend to find their emotional fulfilment in the mother-son relationship." (D'Souza 1980).

The family-marriage-kinship system that links production and reproduction are governed by patriarchal relations in India. The career patterns of high status women is subject to the interaction of capitalism and patriarchy.

Macro forces lay the setting. The historical development of women's education and the historical development of science are both engineered by colonialism and capitalism. Within these forces, modified by patriarchy our science educated women operate. On the one hand, it could limit their options in their scientific career and on the other, it could limit their absorption of science as a liberation from restrictive beliefs, customs, etc.

**Appendix A****REVIEW OF GROWTH OF EDUCATION IN BRITISH INDIA BY AUXILIARY COMMITTEE OF INDIAN STATUTORY COMMISSION, GOVERNMENT OF INDIA, 1929**

<i>Province</i>	<i>Arts College for Women</i>		<i>No. of Women in all Colleges</i>	
	<i>1922</i>	<i>1927</i>	<i>1922</i>	<i>1927</i>
Madras	4	5	384	490
Bombay	—	—	179	382
Bengal	4	4	204	321
Uttar Pradesh	4	5	73	133
Bihar/Orissa	1	1	12	7
Central Province	—	—	2	17
Assam	—	—	15	4
Burma	—	—	50	138
British India including Burma	14	19	961	1933

Source: Summansed from the original.

**Appendix B****GROWTH OF LITERACY FOR MEN AND WOMEN 1891-1951**

(No. per 1000—all ages)

<i>Year</i>	<i>Men</i>	<i>Women</i>
1891	91	5
1901	108	9
1911	114	13
1921	134	23
1931	143	24
1941	287	84
1951	355	129

Source: Review of Education in Bombay State 1855-1955

## REFERENCES

- Ahmad, Karuna (1979): "Equity in Women's Higher Education"; *Journal of Higher Education*, Vol 5, No. 1.
- Ahmad, Karuna (1984): "The Social Context of Women's Education in India 1921-1981", (Paper). New Delhi: Nehru Museum Library.
- Barber, B., (1952): "Science and Social Order", New York: Free Press.
- Barnes, Barry (Ed.) (1972): "Sociology of Science", Hammondsworth: Penguin
- Bernal J.D. (1969): "History of Science", Vol. 1, 3rd Edition, London: Pelican.
- Dedijar, Steven (1967): "Underdeveloped Science in Underdeveloped Countries, in A. B. Shah (Ed.) *Education, Scientific Policy and Development Societies*, Bombay: Manicktolla.
- Degler, C. (1961): In Edward Shils (Ed.), "The Intellectuals Between Tradition and Modernity", *The Indian Situation*; The Hague: Mouton & Co. Publishers.
- Dongerkerri, S.R. (1967): "University Education in India", Bombay: Manicktolla.
- Dube, S.C. (1977). "India Since Independence. 1947-1972", New Delhi: Vikas
- Dube, S.M. (1982): "Sociology of the Professions in India - Emerging Trends and Needed Studies", in P.K.B. Nayar (Ed.): *Sociology in India*, New Delhi: B.R. Publishing Corporation.
- D'Souza Alfred (Ed.) (1972): "The Indian Family in the Change and Challenge of the Seventies", *Indian Social Institute*, New Delhi: Sterling Publication.
- D'Souza Alfred (Ed.) (1980): "Women in India and South Asia, Traditional Images and Changing Roles", *Social Action*, Vol.30 (October - December).
- Embree T. Ainslee (1974): "Tradition and Modernisation in India" - In Ward Morehouse (Ed.) *Science and the Human Condition in India and Pakistan* Bombay: Popular Prakashan.
- Goel: S.C. (1977): "Higher Education and Development", Golden Jubilee Volume, Association of Indian Universities.
- Goslin, David (1974): "Scientist in Indian Society", *South Asian Review*, Vol. 7, No.4.
- Government of India (1986-1904): "Education in India", *Quinquennial Review*.
- Government of Maharashtra (1958): "Review of Education in Bombay State 1985-1955", Pune.
- Kumar, Krishna (1984): "People's Science and Development Theory", *Economic and Political Weekly*, (14 July).
- Mazumdar, Vina (1974): "Higher Education for Women in India", *Journal of Higher Education*, Vol. 1, No.2, (Autumn).
- Mazumdar, Vina (1977): "Education for Equality", in A.B. Shah (Ed.), *Social Context of Education*, New Delhi, Allied Publications.
- Misra, B.B. (1961): "The Indian Middle-Class, Their Growth in Modern Times", Bombay: Oxford University Press.
- Mukherjee Ramakrishna (1958): "The Rise and Fall of The East Indian Company: Berlin: Veb Deutscher.
- Mukherjee, Ramakrishna (1977): "Scientific Technological Revolution, Social Aspects", *Studies in International Sociology*, New Delhi: Sage Publications.
- Nanda, B.R. (Ed.) (1979): "Science and Technology in India", New Delhi: Vikas
- Rahman, A. et al (Ed.) (1973): "Science and Technology in India, New Delhi: ICCR.
- Rahman A. (1977): "End of Colonialism and the Development of Science Policy for New Nations", (Paper). Edinburg: International Congress of History of Science.
- Ramabai Pandita (1901): "High Caste Hindu Women", (Publisher not stated).

- Ramasubban, Radhika (1971): "Science and Society—A Sociological Analysis of the Development of Science and Technology in India", Ph.D. Dissertation, University of Bombay.
- Sen Anupam (1982): "The State, Industrialisation and Class Formations in India", A Neo-Marxist Perspective on Colonialism, Under-development and Development. London: Routledge, Kegan and Paul.
- Sen Hannah (undated): "Education of Women and Girls" in Shyamakumari (Ed.) "Our Cause", Allahabad: Kitabistan.
- Shukla, S. (1958): "Perspectives on Women's Education", *Journal of Sociological Studies*, Vol. 1, No. 1, (January).
- Sridevi, S. (1958): "Development of Higher Education for Women in India", Ph.D Dissertation, Columbia University, New York: (Unpublished paper).
- Tilak, J.B. (1980): "Inequality in Returns to Education", Hyderabad: Administrative Staff College.

### Selected References

- Billington Mary Francis (1895): "Women in India", New Delhi: Reprinted, Amarkis Book Agency, in 1973.
- Bhagwandas (1929): "Indian Ideals of Women's Education (an Address)", Allahabad.
- Chapman E.F. (1981): "Sketches of Some Distinguished Indian Women", London: W.H. Allan & Co.
- Chiplunkar G.M. (1930): "Scientific Basis of Women's Education", Poona, S.B. Hudilkar.
- Cousins Margaret E. (1941): "Indian Womanhood Today", Allahabad: Kitabistan.
- Dasgupta Jyotiprova (1938): "Girl's Education in the Secondary and College Stages", University of Calcutta.
- Ghosha Jogeshchandra (1928): "The Daughter of Hindustan", Calcutta, Sen, Bus & Co.
- Hauswirth Freda (1930): "Purdah: The Status of Indian Women", London: Kegan Paul.
- Maharani of Baroda and Mitra S.M. (1912): "The Position of Women in Indian Life", London: Longmans Green Co.
- McDougall Eleanor (1943): "Lamps in the Wind—South Indian College—Women and Their Problems, London: Edinburgh House Press.
- Murdoch John (1888): "Women in India—What can be Done for Them", Madras: Christian Vernacular Education Society.

# 3

## **The Employed Middle-class Woman as a Conundrum**

Between 1950-1970 there was a plethora of studies in this area mainly by students of sociology. One suspects that part of the inspiration came from American studies as a cursory glance at the bibliographies used show that they draw heavily on American sources. There was a certain legitimacy to this pre-occupation in the American context as it was an effect of consequence of the women's liberation movement spearheaded by white, middle-class women. Research and scholarship tended to reflect this bias. In the Indian case, it was after 1975 that the ICSSR launched a programme of women's studies with a specific focus on poor women and rural women and priorities of funding agencies generated this new development-oriented research and corrected the overwhelmingly middle-class bias of the earlier era. To begin with, the direction of research on women prior to the seventies was derived from the perceptions of that class of society that constituted academia. It is the development debate after the seventies that suddenly brought into focus the plight of the majority of women. We see clearly the shift in problem focus, issues dealt with and in research-subjects. In U.S.A., as the women's movement gained ground, sections of society not previously part of it, began to experience their isolation and began voicing their concerns through Black Feminism, or Women of Colour. The Western women's movement began to be criticised for its neglect of issues of race and class. In India as in other Third World countries, the development process drew attention to class and gender interconnections because it became apparent that women began to be especially disadvantaged in the race for industrialisation and introduction of modern technology. Capitalism was having a virulent effect on not only the poor but also on the masses of women.

It is useful to review these earlier studies on middle-class women to demonstrate how research on women and the women's

problem got structured within a particular framework which was not only a middle-class view but also a restricted one in so far as the woman's question was posed within the narrow confines of an existing social structure with given gender relations. These studies did not talk of sexual division of labour or patriarchy. Taking these as accepted, they merely talked of tensions and how to overcome them. The problem was seen as one of attitudes and not as a structural one where gender relations were in-built into the family as well as work sphere. It never struck any of these researchers that the majority of women in rural areas and in many urban sectors in India were "employed". Nor did it occur to them that women's "domestic roles" have existed for centuries. In other words, there was a total absence of historical perspective. It was assumed that only middle-class women were "employed" and it was assumed that women never before had any role in production—a historical myopia that distorted the entire approach to the question of women's equality. Looking only at a section of society and asking the wrong questions besides, it was no wonder that the studies were monotonously additive and did not enlighten in any way.

The employed educated woman has been a much researched area in the last few decades. The emergence of a large number of educated women in the labour market is a sociological phenomenon that has provoked attention and inquiry because this class of women is a new-entrant in this sector.

The studies fall into three or four categories:

(1) general review studies; (2) different studies on white-collar women employees, dealing with heterogeneous categories of occupations; (3) studies on specific professions and (4) studies on women scientists here and abroad.

The focus in the initial period was predominantly on role conflict; gradually some attention begins in later studies on problems at the workplace.

### **Studies on Employed, Educated, Middle-class Women**

The spate of such studies have provoked some reviews and critiques (Agnew: 1977; Papanek: 1977; Ahmed: 1979; Leonard: 1979; Mazumdar-Sharma: 1979; Choudhry: 1982; Desai-Anantram: 1982) but we go beyond these critiques in some ways.

Desai-Anantram reviewed some sixteen studies of this genre, which covered the period 1951-74. Among the more



prominent ones are Kapur (1970), Mehta (1970), Goldstein (1972), Ramanamma (1972), Wadhera (1976), Misra (1977), Sethi (1978), Chakravarthy (1978), Srivastav (1979) and Mies (1980).

The employed women covered in these works by and large included those employed in middle or lower level white-collar jobs that carry fixed hours of work. They are not comparable to professions that demand a much higher level of involvement. Most of them were based on samples from large cities and as such had a variety of family-household composition. The major theme in most of these studies is "role conflict".

Misra (1977) for example, feels that what ails the educated, employed women is the dissonance between social expectations and her actual situation. "The working woman is seeking a new role fit, a consistent frame of reference to anchor herself to a relatively stable set of values. She wants a change which would give her goodness of fit with the values of society and the system." According to him, the role-person-system-complex is in a flux essentially due to inevitable value-lag.

Kapur (1970) in her 'Marriage and the Working Women in India', has something to say about the attitudes of husbands and in-laws to the employed woman. She notes that the employed woman does not receive any extra rights or privileges by virtue of her engaging in paid work outside the home. Attitudes of husbands and in-laws did not change, while the wife's perceptions underwent a change with the result that conflicts arose and these conflicts centered round: (a) rights over money earned by her; (b) freedom to move about; (c) need for greater respect.

Most of the authors record feelings of guilt among the women for inability to fulfil the familial role adequately. The main focus is on the family though Kapur makes some passing references to attitudes and interactions of male bosses and colleagues at the place of work. Ramanamma likewise harps on stresses and strains while she notes changes in friendship and marriage patterns. All the women in her sample felt ambivalent towards their jobs. It was not house-work which created problems but children. The deepest sense of conflict arose with respect to their desire to get more time with their children for proper socialisation.

These observations are uniformly echoed by most scholars, with minor variations on the theme.

Gupta (1979) and Kala Rani (1976) focus more specifically on job satisfaction. Kala Rani's survey of 150 educated, married, employed women in Patna city included teachers and others. The majority of the respondents expressed job satisfaction and did not think marriage came in the way. She deducted a low "commitment" to job because in the event of any family crisis they were ready to give up their jobs. Their husbands were proud of them and they had a high degree of self-esteem. Kala Rani does not provide any rationale for the measures she has used for these deductions and her not finding any connection between women's perceptions and occupation, educational level and income of the respondents comes as no surprise because they are drawn from a similar class background.

Gupta's (1979) sample was a vastly heterogeneous group that included receptionists at one end and doctors on the other! A uniform job-attitude scale for such a diverse group is faulty methodology. Would aspiration mean the same thing for doctors and clerks or receptionists? One significant conclusion was that all esteemed job security more highly than other benefits. Is this a special failing of women or the reflection of rational behaviour in the face of a tight job market? In neither of these studies are any objective conditions taken into account.

Srivastav's (1977) attempt at investigating attitude to female employment had the merit of a homogeneous sample. She found the employed women had a positive attitude but the unemployed rationalised their status. The length of exposure to education was also found to be a significant variable. While Srivastav concerned herself with women who had professional education, the categories of employment were diffuse.

This ambivalence to employment is mentioned in many other studies. Goldstein's Bangalore students viewed employment as a contingency which could be revoked depending on circumstances, primarily whom they married, when they married and what the affinal family's decision turned out to be. An opinion poll (Monthly Public Opinion Surveys 1968), that covered 500 women in the metropolitan cities of India emphasized this lack of aspiration. "Indian working women share the general reluctance observed in earlier studies to take commensurate risks for prospects of advancement." In all these studies, the

blame is laid squarely at the door of the employed women. There is no hint let alone analysis of the structural conditions that are responsible for this uniformly depressing response. Like most other works, this national survey also lumps together all categories of white-collar jobs.

Sethi's work was a departure in its concern not for job commitment but what really were the changes induced by holding a job. Once again she has a catch-all net for I.A.S. officers, college teachers and stenos. A modernity scale is applied that has characteristics such as assertiveness, participation in the media, freedom from family and attitudes to marriage and divorce. Most of these are elusive of measurement. Another study examines the influence of wives' employment on their husbands by comparing two groups of couples—one where the wife was working and the other where the wife was a housewife. The study found that husbands whose wives were employed tended to have a more egalitarian relationship with the spouse than the other group (Andharia 1983).

To sum up. In these score or so studies the concerns were why did women take up a job, and the stresses at home. The benefits of the job were couched in psychological terms such as more self-esteem. Improvement in job status was not an important issue except as an attitude complex of the employee. We seem to be replacing old myths with new ones.

There is a tendency to depict the situation of the educated-employed woman as a deviant and as a consequence the entire methodology chases effects rather than causes. The total pre-occupation with stress in the family due to paid work abstracts from any examination of previous sources of conflict and stress prior to their employment. Secondly, what happens to working class women? What is the difference in the nature of their conflicts? Interpersonal functional analyses obscures underlying structures, such as the nature of family composition, women's rights, privileges in the traditional set-up and the connection between the nature of the economy and women's roles as between different classes. There is an unwarranted one-to-one-connection drawn between the mere fact of employment and stress.

Even within the parameters of the role-conflict analysis there is inadequate delineation on the precise nature and source of conflict as Desai and Anantram point out. Is the problem one of time, prioritisation, incompatibility?

The few researchers who examine job situations do so solely in terms of a subjective response to the job. There is no analysis of what exactly the job requires and whether it is different in implications for men and women and if so, why. There are no objective, concrete indicators on job status either *vis-a-vis* men or other similar categories. The work environment becomes a "given" and hence not in need of any examination for its adequacy or inadequacy. The diversity in titles or samples is of superficial significance as the matrix chosen regardless of the category of women is a uniform one. Those who do choose a homogeneous category nevertheless employ the same dual role approach (Daftary: 1976; Mhatre: 1978; Ghadially: 1977; Shekaran: 1981).

The review studies mentioned earlier point to the limited focus of these studies and there is an alarming innocence regarding the specific, socio-cultural context within which these women work and live. Ahmad (1979), for instance draws our attention back to some basic puzzles: What is the structure of opportunity in employment for women? What facilitates and what inhibits their entry into certain lines and not others? She pleads for more comparative studies on men and women and deeper investigations of hidden mechanisms that produce discrimination. Leonard (1979) bemoans the near total absence of historical work in this area except for uncritical and unimaginative use of texts. Agnew likewise feels that the Indian tradition with regard to women's position has never been subjected to an impartial and objective, critical scrutiny. The glorious past – sullied by Manu – is the accepted version. Papanek rightly remarks that inspite of extending social research methods to a new clientele of women there is little understanding of the ongoing social changes that will and must affect the most basic aspect of these societies. She sees a need for reformulation of social theory and methods by beginning at points where we now have looseness and uncertainty.

Our dissatisfaction with the "dual-role" approach is that it fragments the world of work from the domestic scene in a stark contrast, depicts them as discrete spheres at war with each other. The linkages between the two and mutual reinforcement have not been perceived let alone examined.

Conditions of work of lower class women move out to another level altogether, examining only the exploitative conditions of work in female dominated industrial sectors (Krishnaraj: 1982).

### **Studies on Specific Professions**

There have been some studies that addressed themselves specifically to career motivation among different categories of occupations and professions such as teachers, bankers, medical graduates. Teachers are the largest segment of the professional work force and usually have better educational qualification. According to Karuna Ahmad's review (1973-74) they are neither dissatisfied nor satisfied with their occupation. As an occupation, it requires very little training (college level) and "women have less long-term commitment." She noted an increasing tendency to continue after marriage. A likely motive is self-expression, but the need for self-expression according to Karuna is "more due to boredom of finding themselves in an empty nest than a strong identification with the world of work." Teaching was congenial to women because it led to less interaction with men and was more compatible with home and family responsibilities.

Uma Shankaran (1981) had tested men and women in banking for variables such as job involvement, sense of competence, self-esteem for work, internal motivation to work, satisfaction variables (pay, job security, social interaction, supervision, growth) and job complexity. She found no significant differences between men and women, on the whole except for women being less involved than men and their perception of jobs as less complex. Women also had a higher level of global satisfaction from their work. "women are competent and serious participants in the labour-force with jobs playing an important role in their lives. Making a strong commitment to involve women in positions of responsibility will tap their experience."

Sharayu Mhatre's (1978) study of women in the banking industry which took a sample of 165 persons from 7 nationalised banks in 1977 found very few women were in senior positions in the early sixties and they were unmarried. The position has improved with the management favouring women employees because: (a) they act as a check on union militancy; (b) they are more tactful with clients; (c) they are good at monotonous/routine work. Male colleagues resented the women, and felt they enjoyed too many privileges while senior officers were "kind" to women, which behaviour the author thinks is evoked more by their perception of female employees as "faithful subordinates" than potential competitors. She also refers to the need for women to overcome their desire for security and feelings of dependence. In other words, she would want them to become more competitive

and assertive. Mhatre emphasized both aspects: male attitudes as well as women's lack of militancy. G. Bhargava (1982) did a study of sex differences in the professional identification of medical students. Conceptualising professional identification as career commitment, career satisfaction and professional self-image, he found the score for women lower. The author explains the differences as due to early sex role socialisation, cultural norms and the organisation of the medical college.

Daftary (1976) argues that women managers come from the highest strata of society and it is precisely this class of women that requires release from traditional restrictions that bedevil a caste ridden, feudal hierarchical society. But these women as "managers" of household have a built-in capacity to weather stresses and strains, have greater endurance for toil and a greater capacity to bargain and suffer. They have all the prerequisites. What women need is the *opportunity*. Daftary does not think women are meek and submissive and incapable of leadership positions. She does not go into the question of whether women aspire for that role, she assumes it to be so.

Karuna Ahmad (1984) in a later paper, argues that the low professional commitment and discrimination flow from role perceptions and self-images imbibed through the process of socialisation. The problem of the professional woman is basically that of the urban, educated women. She looks upon work as only an addition to her traditional role. As a result, she does not perceive any discrimination and does not set any high career targets. Most women even though employed, find it extremely difficult to transcend the constraints put by socialisation. Therefore, even when they work, they do so with the understanding that they will continue to perform their traditional "role" perhaps with modification.

A number of other related studies try to explore the implications for women on their being employed— The Indian Working Women—New Horizons (1968) presents the general sociological understanding today. These are: (a) the employed educated woman has come to stay and is no more a new phenomenon; (b) there is an increasing tendency among women to turn to the world of work for areas of satisfaction; (c) the educated woman as co-earner has become an accepted proposition among the middle-class. However, the educated employed woman places job security higher than upward mobility; (d) the combination of

home and career are no longer seen as a terrible dilemma but adjustments are made that run smoothly with no guilt feelings; (e) there is a higher measure of self-esteem because of being able to do something worthwhile, and to be able to contribute to a better standard of living. This summing up of the situation of the educated woman as having obtained a "wider role" and benefitted psychologically from it is echoed by other scholars—notably Suma Chitnis (1975)—who while agreeing that the traditional responsibilities of women as wives and mothers no doubt persist, argues that despite these limitations, women have won a larger inner space for themselves. Compare this change in perspective (prompted by the confirmation in social facts) with the earlier studies in the sixties that still grappled with role conflict. [Kapur (1969); Mahajan (1966)]. Surti (1981) continues the formulation of the problem in the role-dissonance tradition as the problematic, but notes that employed women in fact are efficient time managers and have evolved adequate coping styles but they have conflict-avoidance styles more than action-oriented styles. None of these authors raise the issue of equality but are overly preoccupied with the transformation that employment has brought into the lives of women; though they all note the "burdens" or "stresses" they also emphasize the positive elements in the situation. The only dissenting voice is that of Wasi (1972) who feels that this delicate balancing might not be helpful in an increasingly competitive situation, with larger number of women entering employment and with inflationary conditions putting pressure on women to work. In other words, taking up employment is today less and less of an option even for the middle-class woman. It has increasingly come to take on a compulsory aspect as in the case of men. Under these circumstances, old styles of "coping" or subservience at the workplace may prove too costly for the professional woman. Whether she wants it or not she is being dragged into the competitive fray. Kanekar and Kolsawalla (1977) bring in another less perceived dimension to this debate on "lower career motivation" and its causes. The more respectable a job is, the greater the willingness to shoulder responsibility. One could therefore turn the tables and say "women are less willing to take on responsibilities" because they are in a subordinate position in any case. Why take on extra loads when nothing much is going to come out of it?

### **Empirical Studies on Women Scientists (and Other Technical Personnel)**

There has been a new interest in the status of the Indian woman scientist since the mid-seventies. Plausibly, this curiosity is provoked by the fact that unlike the woman doctor who has been around for quite some time and the rationale for whose emergence is easily understood as a need to treat women-patients, the woman scientist is a new phenomenon. Her visibility as a distinct category of the professional woman, could not fail to be noticed, when research interest of the earlier decades on the general educated employed women began to crystallise into more differentiated studies within that group. Secondly, the rationale for their emergence cannot be explained as meeting some specific woman's requirements as in the case of the woman doctor.

A brief review of the kind of studies hitherto undertaken in the last few years will tell us something about: (a) the problem-focus; (b) the perspective within which the problem is posed; (c) the implicit assumptions that inform their analysis. We propose to see not only what the problem was seen to be and how it was conceptualised and studied but also uncover the limitations of these studies. The work examined is not uniform in either coverage or quality but they are included here for the issues they bring to the fore.

The first effort made in this direction was by women scientists themselves. An Indian Women Scientists Association (IWSA) was formed in 1975. IWSA mooted a small, explorative study in collaboration with the SNDT. Women's University, wherein the present author analysed the questionnaires filled by IWSA members. (SNDT Women's University and IWSA 1975). This survey sought to find out: (a) their employment status; (b) job satisfaction; and (c) obstacles to career. Of the women contacted 208 women responded and of these 178 were employed, all in Bombay, except three. Though the sample was not scientifically or rigorously selected, the findings have some value as they traced some of the contours of the problem. The sample composition was as follows: 49.4 per cent from Department of Atomic Energy; 12.9 per cent from hospitals and other medical units; 15.7 per cent from colleges and university departments; 18.7 per cent from pharmaceutical companies and 0.05 per cent from computer services.



The major findings of the study were: (a) the majority of women were below 30 years of whom half were married and the married had 1–2 children; (b) most married women had continued to work after marriage; (c) 80 per cent were in pure sciences with two-thirds having post graduate degrees; (d) the majority said they were satisfied with their jobs and were treated fairly though 20 per cent were unhappy, these being library and research assistants; (e) promotion prospects were not very bright; (f) there was family support and encouragement but some proportion of mothers had child care problems.

The study had several limitations apart from the nature of the sample. It did not distinguish very clearly between married women and unmarried women; there was no clue as to whether there had been breaks in their career and if so why; aside from general opinion questions, there was no data on the kind of support available at home. "Support" may be interpreted in a variety of ways and the response may be positive or negative depending on one's level of expectations.

A more serious lacuna was the inadequacy of information obtained on their job—the nature of work, recognition received, openings available, challenges faced etc. The organisational structure was totally missed, and different, diverse kinds of sectors were treated alike. Despite these shortcomings, it was an important and essential beginning.

Later, Begum and Balaraman (1975) abstracted the data on the Bhabha Atomic Research Centre (BARC) and tabulated the results on two or three aspects, separately to get an idea of their own organisation. BARC is the largest scientific establishment in India and it employs over 1000 women of whom 157 are scientists.

Begum and Balaraman covered 68 cases and they found that: (a) 60 per cent had a strong financial need but 75 per cent had career ambitions; (b) the number of persons dissatisfied were few and they were in the group with more than 10 years' experience; (c) promotion prospect in general was held to be not good; (d) more than half the women felt there was equal treatment with men, with only one fourth dissenting; (e) out of thirty five women with children, nearly half had problems of child care.

The authors concluded from this that women have to work extra hard to get along, that disparities with men widen with

years. Their analysis as to causes were the lack of child care services by the organisation and the social conditioning of women that makes them unwilling to protest against their subordinate status—conclusions that sprang more from their own personal convictions than from the data itself. In the absence of actual job ranking we have very little objective support for these statements.

During the same year, IWSA (1975) had called a meeting of women scientists and engineers to exchange experiences. The general tenor of the presentations (oral) was on how despite the vicissitudes of marriage and motherhood, they had survived and contributed to science out of sheer persistence, determination and interest in science. The Conference was a forum for celebrating individual success stories but threw little light on what obstacles women scientists as a group faced in the context of the nature of their work and nature of the organisations where they worked. It did not touch at all on the issue of equality, because their sense of achievement was more for the work they had done than for their job status in the scientific hierarchy. A few who were heads of organisations did not reveal how they got there. One could not help noting that the conference indirectly appeared to exhort women to be “superwomen”.

A different kind of study was that of Ghadially and Verma (1980) which attempted to evaluate the career orientation of boys and girls at IITs. In a way, this is significant because IITs are the most prestigious and elite institutions and if girls have got in, that in itself represents an achievement. Having got the access to a highly prized educational course, how did they visualise their future? Within the sample, the girls were more in science than engineering even though the girls had a more outstanding academic performance before entry. What is notable is the difference in motive: to the boys being in IITs was primarily because of better job prospects but to the girls the more important thing was that it was intellectually challenging. Other differences seemed to support the opting-out theory—for example, the girls envisaged a future in teaching/research while the boys aspired for managerial positions. Again while to the boys, a career was the central interest in life, to only 48 per cent girls, career had a similarly strong pull though all of them planned to work full time. The discrepancy in attitudes comes out even more strongly in the expectations they have regarding their future spouses. The boys wanted non-working or part time working wives but the girls expected both themselves and their future husbands to work full

time. There was only a slight hint on the structure of courses and the organisational milieu. The girls had more problems coping with them and sought the advice of others more often.

The results are in many ways interesting but very predictable, *the perception of the respondents mirroring the reality they experience*. The girls had also reconciled themselves to having to manage home and career, but the boys did not seem to see the need for any change on their part.

Jaiswal's (1981) approach is less of attitude and seeks to capture the status of women relative to men in the work hierarchy. Taking a matching sample of men and women, he traces their relative status: (a) the group was below 35 years in age, the women being much younger; (b) more women were married at younger ages; (c) in 27 per cent cases women had superior qualifications; (d) salary wise only 34 per cent women were in the over Rs.1500 p.m. grade whereas 58.7 per cent men had reached it, but the women were relatively more "satisfied". (57.7 per cent against only 20.8 per cent among men.)

Besides this, the women had husbands who were engineers or equal level but the men had wives who were mostly housewives. This confirms the finding of many other studies that women in the higher professions belong socially to a higher group than the men there.

The women engineers shouldered the responsibilities at home more or less on their own with little help from husbands. Once again, this is a corroboration of: (a) inferior job status of women; (b) extra burdens on them; (c) unchanging male expectations and attitudes; (d) women's "acceptance" of their lower job status.

Chakravarty and others (1984) study is the most recent one and the only one that focuses exclusively on research-scientists and is therefore a valuable contribution. However, it being not designed as a study on women, many parameters are missing and we have data on end results but no clue to the process which results in a subordinate position for women.

Drawing on a sample of 118 women and 1032 men scientists from 250 selected establishments, they attempt to capture the work performance of the group. The research design was dictated by the objective of evaluating research performance in 6 countries.

Their findings were that women belonged to a younger age group, were concentrated in bio-sciences and only 4 per cent were at any senior level.

Their analysis of the work patterns of men and women brings out further evidence of the subordinate status of women. The women were involved in "pure" research activity to a greater extent and had less involvement with administration which implies that they had less involvement in the decision-making processes of the organisation. Though they were engaged in pure research to a greater extent than men, the kind of research they did belonged less to analytical and creative category and lay more in compilation collection and review category. Secondly, though there was very little difference in productivity as between men and women in terms of books or research papers, when it came to patents and innovative, experimental devices, there was a sizeable difference. (43 per cent men had this accomplishment, against only 20 per cent women.)

As compared to men, women did less voluntary overtime. They also saw their supervisors as congenial and supportive and interacted with them more frequently and valued job security more than job status. All these seem to suggest either that they have a lower level of independence and competitiveness or alternately that they are co-operative by nature.

The authors in attempting to "explain" these differences quote Western studies that talk of the male culture of the science establishments and the absence of the invisible support systems in terms of networks that bring recognition and opportunities to men.

While I am in sympathy with the hypothesis it seems to me to be a speculative leap from data to hypothesis. In order to establish this male culture one will have to see: (a) whether they operate in the Indian cultural milieu; (b) if they do, how exactly does it work.

They also make several contradictory statements such as "women's productivity is less because they have a subordinate status" when in fact according to their own data there is marginal difference in productivity. What they in fact have to explain is.

- (1) To what extent does overtime contribute to enhanced job status.

- (2) Why are women not in administrative position—is it by choice or were they excluded?
- (3) In what precise way does the time and work pattern come in the way of women? If they are putting in the same number of office-hours, if they are “devoted” to their work, if they are well qualified, then where and how do the men get ahead? Is it by better recognition that comes from informal male networks? We need to show how despite similar quality work, women did not get recognition—something hard to obtain by surveys.
- (4) If according to the study women are doing less creative work is it because they are unable to or is it because they do not get opportunities? Do the men “study” more at home? Are the women more different? Do the women find analytical work uncongenial due to feminine preference for the concrete?

The authors seem to be saying that women have feminine qualities that do not find scientific organisations congenial; they are also at the same time saying, women do less well because they have fewer opportunities. Perhaps there are both aspects at work though what is “feminine” is very difficult to establish, because one will always end up by saying that traits are not “natural” but acquired through conditioning.

The constraints on women’s creativity as being due to the double burden is too general a statement. Dual burden affects all women but we tend to club together the vast differences that exist in the nature, quality, arduousness, duration, degree of tension, immediacy etc., of housework and child care as between different classes of women and different types of families.

Visalakshi and others (1983) mention that women constitute only 7 per cent among the awardees. Their study discusses more whether recognition stimulates more productivity and helps in providing a suitable environment, rather than whether the prizes awarded are always “fair”. Does visibility of a particular scientist count? Do contacts mean more access to publication channels? Do men have more “mentors” who promote them? These questions are unanswered at the moment.

Their findings document how opportunities become cumulative. Prize winners get to work in prestigious institutions, get more resources, etc. The indirect implication could be that if

women get left out in the first round, they are unlikely to catch up later.

The Indian studies on women in science seem to affirm consistently, the following:

- (1) They have a subordinate job-status in terms of salary, level of post, influence-potential of the post, prizes received etc., and this position worsens with years.
- (2) There is no difference in the productivity level or job-status level as between married and unmarried women.

The explanations until recently was the implicit dual role model. Only now, perhaps because of more extensive feminist literature from the West being available and the growth of the women's movement within India itself there is a noticeable shift in the parameters of the discourse and the formulation of the discourse itself. Earlier, the discussion centred on the personal distress of women in "managing" home and career but now there is some awareness that there is subordination at the place of work too. In the framework of the discourse, from dissonance in psychological terms, a questioning has begun to whether the structure (sexual division of labour, industrialisation, work schedules, occupational classifications and their valuations etc.) itself is not at fault and whether women as a group can achieve equality within the structure. There is an implicit patriarchy-model here though either the concept or the terms is not used explicitly.

During the mid seventies a feminist *concern* inspired the inquiry but the perspective was limited to how women can accommodate themselves within the givens of the system. In the eighties, there are gleanings of more radical feminist *perspective*. Though neither the analysis nor the data is very far from being worked out to yield an adequate theory, the old answers are no longer satisfactory and new questions are being posed.

### **Women in Science Abroad—the Problem and the Perspective**

We have available studies done mainly in the U.S. and to some extent the U.K. While macro statistics may be available for socialist societies we have no information or analysis based on research. For illustrative purposes we have included some general articles from these countries to underscore the recurring theme

of gender inequality and discrimination. Such a review is valuable to help us appreciate the contrasts in India.

Historically, women in the West faced open discrimination and entry itself was difficult. Despite significant contributions, women scientists had to wait a considerable time to be accepted and given recognition. In the U.S. the growth of the women's movement aided this process.

Throughout much of the eighteenth and nineteenth centuries, upper class women in England and U.S.A. engaged in scientific work in their own private capacity and in their own homes (Meyer 1955). Their efforts to participate in science and be recognised by the scientific community were tentative, defensive and very round about. On the one hand the intellectual climate of the period was infused with the spirit of scientific progress and an ardent faith in science and rationality. Darwin and Newton had contributed in no small measure to a new outlook on the place of human beings in the universe and to a faith in human capacity to understand, regulate and predict that universe. Simultaneously, the strong Victorian ethos of women's proper place bound upper class women of the time tightly within the confines of the definition of womanhood of that time. Caught in this contradictory milieu many women practiced science at home; they set up their own microscopes and telescopes; cultivated herbaria; had entomological collections of their own. They justified and rationalised this activity as being properly religious, as a way of enhancing faith in God by getting to know the wonders of God's world. In other words, they violated no cultural norms of women's "proper place" for they were engaged in activities that rebounded to the greater glory of God. Much of this activity was done in private. These early scientific ladies presented their papers to local women's clubs, Sunday groups and Church organisations. Many women botanists were single women. Some of them had their own local women's natural science societies.

Some of their discoveries were often presented by men or the credit taken by men. Many inventions by women were patented by men. A famous example is that of Ellen Eguli (Amram 1984) who devised a new clothes wringer but she let a man make a fortune out of it for fear that she would not be given a patent as a woman. Women scientists at that time never achieved public recognition, commensurate to their skills. This pattern of private and isolated study of women where they relied exclusively on

informal networks continued till well into the nineteenth century. As the scientific community professionalised, it limited the acceptance of all those who were perceived as amateurs. This happened very noticeably in Western Europe and America. Nowhere was this process of edging out women more pronounced than in the healing professions (Ehrenreich and English 1973). Often discouraged by this lack of independent credibility, many women either assisted male scientists or allowed the men to take credit. Mary Summerville (1780-1872)\* had to have her brilliant paper on "The magnetic properties of the violet rays of the solar spectrum" presented by her husband because the Royal Society of London would not admit women. Only after the publication of several outstanding books on the physical sciences did she finally obtain recognition, which really came towards the end of her career. She received a government pension and had a college named after her.

The U.S. Patent Office issued patents to women innovators only a century after it came into existence (See note at the end of the chapter). Sybilla Master's invention of a machine to clean corn bestowed prestige on her husband. On the contrary of the U.S. Patent Office, women published a newspaper called the "Women Inventor". In 1910, women's patents numbered 8596 but they were only 0.8 per cent of the total. Inventions require time, money, material and opportunity to share ideas. Historically few women had any of these. With no property rights, women had no financial independence to bring to fruition their ideas: in a segregated society there was little chance of intellectual stimulation.

The number and range of their inventions grew after 1910 but the nature of their inventions was, as is to be expected, very much a function of time and place. The creative woman's horizons were bounded by the household and farm, and hence much of their attention was on things like dress, reform, easing domestic burdens, etc. (Mary Florence Potts invented a special iron in 1876). Women were becoming aware of the lack of opportunity. In 1890 some American women submitted a petition to the U.S. Patents Office, whose substance and tenor rings strangely contemporary.

Sally Kohlstead (1978), discussing the history of women in science (1830-1880) in U.S.A., shows how women were no longer



content with private study and their own romantic notions of natural history, as they began to meet men of achievement and had glimpses into the world of research. During 1820-30, popularisation of natural history gave women opportunities as teachers and illustrators. Women's colleges vigorously supported science education. By 1840, a few outstanding women had entered the scene and though the professional scientific community was still reluctant to accord due credit, feminists and the public gave support. Along with the growth of women's clubs there was a parallel growth of small, local scientific societies. In this process of growing receptivity to women's scientific activities, women's reform groups, special study groups, summer schools, etc., played an important role. The largest support after the first World War came from women's colleges.

Rossiter (1974) found that the early women's colleges stressed bio-sciences. Employment for women qualified in science was mainly in academic institutions (68.3 per cent total women) and a bare 9 per cent worked in research organisations. The impetus to opening up of new careers in science came largely from the development of higher education in the late nineteenth century. Growth of higher education for women in the U.S. was far more closely intertwined with the rise of the woman scientist than it was for the woman doctor or lawyer for whom colleges played a relatively indirect role. Women's colleges were more important for women scientists than the new colleges and universities were for men. Around this time, women did not publish much but the second generation began going into research. Unfortunately around this time when women were breaking barriers new hierarchies were emerging within science, with professionalism in science increasing, with rising scale and cost of scientific institutions and growing urbanisation. The virtual segregation of women in the women's colleges excluded their integration in the profession; the National Academy of Sciences did not admit women till 1925. The War opened up new careers in science (e.g., home economics ran war related courses); they found some places in government and industry, especially industrial chemistry. "Though women were now a little stronger, they did not capitalise on their gains" according to Rossiter. What is significant to note from our point of view in this brief historical account is that though women scientists were highly motivated, earned degrees, published papers and did important work, recognition came only in terms of modest personal prestige

and they never got very far or rose high in the scientific establishment hierarchy. This appears to be the case at present for Indian women too.

The contrast in our case is that Indian women did not have to fight a hard battle for *entry*. Nor was the achievement of women scientists the result of backing by women's organisations and women's colleges. Opportunities for science came automatically with the growth in university education and growth of scientific establishments needing educated persons.

There is now a growing literature in the West on women and science/technology. In 1964 (Mattfield and Van 1965) a symposium on women in science and engineering at MIT noted the unequal position of women. Women's lower career status was seen as arising from: (a) inadequate training; (b) interrupted careers; (c) lack of re-training, which in an area where knowledge grows fast, leaves women disadvantaged if they seek re-entry; (d) avoidance of scientific careers by women due to fear of losing femininity; (e) the absence of mentors for bright girl students who would promote them. The perspective in these papers was that of the dual roles and in fact what was advocated as a solution was that women should do some long range career planning which would include their roles as mothers and wives also. They wanted part time employment which will enable women to build a career alongside their family responsibilities.

A decade later came the special study on 'Determinants of Success'. By this time, the feminist movement had grown in the U.S. While American women were still concerned with political rights, professional opportunities, legal and economic equality, they began to be more and more concerned with basic changes. There was a search for satisfying alternatives to the stifling, rigid sexual division of labour and its consequences in pushing men's and women's lives into straightjackets. The literature at this time abounds on the implications and consequences of sex role stereotyping, on concepts of masculinity/femininity. In the 'determinants' books, the authors sought the right psychological environment within the family that would provide new models for women. By and large they focussed on the structural imbalances in the experiences of boys and girls within families derivatively, by showing how women *could* succeed in so called masculine fields of endeavour if gender-role anxiety was not cultivated.

The successful woman scientist had a special kind of upbringing which encouraged abilities that bring success: ability to function autonomously; socialized power motivation that expresses itself in exerting a positive influence on those around rather than in personal, class relationships; being a vital, independent, interested and interesting individual, not losing their self-esteem but being able to balance achievement while retaining their identity as a woman etc.

According to the authors, such a woman can be produced from a positive environment where parental role, and even more importantly, father-husband role generates an atmosphere where both girls and boys can grow up without anxiety about their gender identity. This can come about only if the male-stereotypes change and fathers/husbands cease to be mere economic providers but play a central role in family.

Some of the authors also questioned the success-ethic of Western societies and wanted a modification and re-assessment of institutions and social attitude that could give us some viable and more balanced alternatives. In the quest for change, the effect on children should not be ignored and the new institutional and family arrangements must balance the needs of men, women and children.

The implication of the major thrust of the argument is that men and women must share equally in family responsibilities (both physically and psychologically) and while men must develop nurturing qualities, women must learn to be more autonomous. To be able to do this, men must cease to run after "success" and "achievement" in the competitive sense. Social attitudes must change to permit these transformations.

We notice here the outlines of the "implicit" patriarchal model becoming more clearly explicit. However, there is no linkage in this feminist utopia, in this androgynous, conflict free homogeneity with the economy. Competition, individual achievement are the base of a market economy. How would one repudiate the market values in a market economy? The authors fail to see this contradiction.

A different kind of study is Cole's (1979) well designed large scale empirical inquiry that attempts to evaluate the extent of discrimination by using quantifiable indicators.

Taking 2000 men and women doctorates in science he did a longitudinal study of their careers over a fifty year period. Research-output, their quantity and quality, prestige of the institution make a difference to rewards. Making adjustments for these, he tried to see if given all equal qualification in every way, is there discrimination? Inequality is not discrimination. Cole defines discrimination as the residuum that cannot be explained after all inequalities are accounted for. He found that women had higher IQs; there was no discrimination in admissions or graduate fellowships, no differences in possibilities for receiving awards. However, in teaching establishments he found women consistently less rewarded. Marriage and children did not seem a hindrance, for the research output of married women was in fact greater.

Elaborating the possible reasons for this residuum of discrimination in an otherwise "fair" system, Cole (1980) attributes women's failure to achieve fair rewards to a system of invisible discrimination. Men have special opportunities in terms of informal networks, after dinner discussions, teacher-student interaction etc. which women miss out on. "Fair Science" is more fair to men than to women!

Cole's methodology cannot be faulted. Yet there are nagging doubts. Can discrimination be filtered out as a neat residuum, when in fact all the variables interact with each other in a complex way so as to result in a state of cumulative disadvantage to woman? Citation is usually the index of prestige but Cole himself admits that women's work is cited less often. An important requirement for reward (aside from quantity and quality of research output) appears to be "visibility". If women are less visible either because they exclude themselves from the network for reasons of family responsibility or get excluded by a male culture or both, then obviously they lose out. The assumption that career outcomes are based on productivity ignores the important influence of institution and mentor whose prestige influences productivity itself (Stein 1983).

Granted that discrimination *per se* can be proved only if a group of men and women are matched in all respects, I would still contend that "inequality" is itself the result of prior discrimination, i.e., if women as a whole group are less qualified, is it not because of unequal opportunities? How can one assume away the major problem?

There are other observations and remarks scattered through journal articles which though not thoroughly researched as the above studies, are important for understanding how the problem has been conceptualised.

To many, there are fewer women in science and engineering because girls do not choose what their parents and society consider as inappropriate for girls (Blackstone and Weinreich 1980). Comparing the educational attainment of girls and boys at school level, they find that there are less girls than boys at A level; the gap continues to widen at university level. Girls form only 30 per cent in polytechnic, but are 60 per cent in teacher training institutions. Girls fail to reach their potential because they opt out of certain areas of activity. Parents do not discriminate between boys and girls consciously. The powerful agent is social expectation regarding appropriate gender behaviour. The conditioning is indirect. Studies done in the U.S. show that while girls and women attribute their success to luck and failure to lack of ability, boys and men do the reverse. Boys find in failure a challenge while girls are cautious and have "lower" aspirations. The authors think this is because of a realistic perception by girls that career is only a part of their life which includes home, husband and children.

Abson Kelly, (1981) thinks the view of science as a male subject is Western. In Japan and in socialist countries girls do very well in physics. A solution would be to make science compulsory.

Daphne Jackson (1980) argues that physics as it is taught today is highly abstract and mathematical dealing with examples from mechanical and electrical devices makes it uncongenial to girls who prefer life-centred, persons-centred word-centred knowledge.

Georgina Ferry (1982) reporting on interviews with employed women scientists says there is a negative male attitude, that women in science are not taken seriously, and that most of them lower their aspirations in order to cope with their other responsibilities. She was perturbed by the respondents saying they were "satisfied" with their career rewards.

Selcox (1980) contends that the "choice" argument is one-sided. Are all boys doing science because they are interested? After the War science has become very important and men crowd

into it, even if they are interested elsewhere because of career prospects.

The presumption that science is uncongenial to women or that women are not "trained" to be able to work at science is a running thread in much of the literature. Tosi (1975) blames women's lower career status on their lack of intellectual daring and competitiveness. "What characterizes women is a certain perplexity and timidity and the distressing sensation of being dominated by contradictory impulses. It is difficult for them to be prepared to meet the exigencies of scientific work which requires the channeling of intellectual energies towards a single objective." Tosi seems to think women do not meet the intellectual standards of science because they withdraw from competition and find satisfaction in being wives and mothers. Those that display such intellectual persistence however do not do well because they do not have mentors. A very contradictory position! If what ails women is their lack of the necessary intellectual daring how come, they do not do well even after developing it?

Throughout this discussion we can sense the deep ambivalence that feminists have towards their femininity. To succeed in a male world seems to require the surrender of femininity but doubts creep in at once on whether women should aim at equality in a male world and throw away something valuable in the process? Is it possible to be *women* and still be equal to men? Science poses a particularly disturbing area in this respect.

So far there have been no voices raised about the relationship of the kind of science we have to the kind of economic-political system we have. All the preceding authors talked of *maleness* of science in general. Feldman (1975) points out that science as at present organised, is a competitive, elitist and isolated activity without community participation. While earlier, science was pursued by a few to serve the interests of the ruling classes (e.g., the royal physician etc.) today science is a basic substratum of consumer society. Within the precincts of science, women get left out because modern science in its highly professionalised form devalues all traditional skills.

Vitter's (1981) analysis of national data for the U.S. in the seventies gives us an idea of the current status of women. There has been a very significant increase in the last decade in science education for women. Between 1970-80, women's enrolment in all faculties at Bachelor level increased from 43 to 49 per cent of

the total, at Master's level, it increased from 13 to 30 per cent. For science and engineering the corresponding increases at Bachelor level were from 26.1 per cent to 36.9; Master's level 17.5 to 23.7 per cent and doctorate level from 9.1 per cent to 22.6 per cent. In the total scientists pool of doctorate holders women were 12 per cent in 1980. While the annual increases in science enrolment was 0.4 per cent men, it was 9 per cent for women. These trends are strikingly similar to those in India.

Other significant aspects are: (a) women scientists are 18.1 per cent of the labour force and 90 per cent Ph.Ds. are employed; (b) unemployment rates for women B.Sc./M.Sc. are 5 times higher than for men; (c) most of the women are employed in academic sector but rank lower and have vast salary differences to those of men; (d) salary differentials increase with age.

Women are not welcomed in industry and though colleges may welcome returning women students, job opportunities are shrinking.

It took American women 144 years to get the vote, it took 187 years to get a law for equal-pay-equal-work. Compared to that progress in science education in one decade is striking.

We do not have much information on other Asian countries. I came across only one on Burma\*

#### **BURMESE STUDENTS IN PROFESSIONAL SCHOOLS**

Years	<i>Medicine</i>		<i>Dentistry</i>		<i>Vet. Science</i>	
	W	W%	W	W%	W	W%
		T		T		T
1966-67	185	38.5	12	20.0	5	7.1
1975-76	266	47.4	13	17.8	31	20.3

Years	<i>Engineering/ Technology</i>		<i>Education</i>		<i>Agriculture</i>	
	W	W%	W	W%	W	W%
		T		T		T
1975-76	130	23.6	276	78.6	33	16.5
1975-76	79	12.6	300	71.10	67	32.5

\* "Women Technicians in Small Countries", *Impact of Science on Society* Vol. 30. 1, January-March, 1980.

In 1975-76 Burmese women students were distributed as follows in the sciences: 1129 women (45 per cent total) in chemistry; 1218 in physics (49.5 per cent total); maths 1064 (42.9 per cent total) zoology 1469 (62.8 per cent total) botany 1146 (57.8 per cent total) and geology nil.

The proportions are much higher than in India, but even then bio-sciences have more women. In the teaching sector, there is not a single woman at professor level, they are 22 per cent at lecturer level but at assistant lecturer and demonstrator level they are 83.4 per cent. Hardly a surprising phenomenon! the reasoning of the author is rather peculiar. She says women have equal rights to education and employment but *men have social precedence*. There are fewer women in engineering because of "personal" characteristics of women (they do not like it?). At the same time she also says for entry into engineering, women require *more* marks than men! She claims that career women are able to do well because of help from relatives and servants. Though prejudices remain (a woman cannot become a Buddha; she has to be reborn as a man to become a Buddha) these prejudices do not affect the rights of women according to the author.

As in India, other ex-colonial countries display a similar pattern—women from upper classes gaining access to higher education and being able to pursue a career because of "relatives and domestic servants."

Information on socialist countries is scanty. Gleaning through the papers presented at the Fourth International Conference on Women Scientists (1975) in Bulgaria a paper says that improvement in career can take place only with constant retraining and upgrading of qualification and women do not get this time; though social mobility for people as a whole is considerable. (Of the scientists and engineers, 43 per cent come from a family of clerks, 40 per cent from factory workers, 15 per cent from peasants and 2 per cent from tradesmen). The median age of a woman engineer is 30, she is most creative after 36 when her children are grown up. The author says "there is need for a differentiated approach and not a mechanical levelling of labour of men and women."

In Poland, there is steep occupational segregation of the sexes. The author questions this and why there should be wage gaps and skills between men and women. She pleads for an in-



dustrial structure that will provide equal work opportunities for men and women. She thinks that unequal wages are due to lower skills of women and that these lower skills are because of traditional choice of professions dictated by ideas of masculine/feminine.

In the U.S.S.R. while women are 40 per cent of the total scientists, women have only half the time available than men for further studies because of the "double day" and so there are twice as many men compared to women with advanced degrees.

What have been the solutions offered to encourage women in science? The solutions depend on the analysis. By and large the programmes adopted in various countries veer round persuading more girls to take up science. None of them talk of what happens once they enter the science establishments or how to eliminate inequalities in rewards therein. Is the assumption that of critical ratio theory? So long as women are in minority status, they have an inferior status; if they invade science in large numbers, the position will change. Will it?

Harding (1983) describes the measures taken in different countries. Where there is choice in the curriculum, there is counselling. This is done by introducing them to models of women scientists and discussing career opportunities and rewards. Where there is no choice, enrichment courses are given. Many countries have projects to reduce sex-role stereotyping. In Sweden, counselling centres discuss the growing disenchantment of young people with science and technology and the high dropout of boys and girls from science. In other countries there are programmes of "consciousness" raising.

This emphasis on providing "encouragement" in the absence of other major changes that govern women's lives (the family, marriage, sexual division of labour) would end up by blaming women if they do not make use of these opportunities and therefore this concern is at a superficial level.

The enrichment courses (Report of the Women in Science Workshop 1977) in U.S.A. also assume that women who are in science careers are the products of superior experience.

A UNESCO (1980) document cites the following reasons for the low career status of women in science: (a) inadequate career guidance to girls; (b) prevalence of sex-stereotypes that regard science as suitable only to boys. The attitude of society must

change in all sectors – schools, training programmes, employment systems. There should be more facilities for children. The major emphasis in the document however was on career guidance.

Yogev (1983) has given a good summing up of the changes in perspective in research in this area of professional women. Till 1960 the career woman was regarded as deviant and was therefore presumed to suffer from psychological conflicts. The career woman was seen as competitive, aggressive, intellectual in a "masculine" way, who was therefore socially not well adjusted. The home-maker on the other hand was seen as tolerant and socially better adjusted. The traditional occupations of women (nursing, teaching, service occupations) conformed to feminine attitudes but the pioneer occupations were conflict producing because they were less feminine.

Thus, normative priorities that produce conflicts were falsely attributed to psychological characteristics and because "women" were defined in male terms (sex objects or servers) femininity and individual achievement became mutually exclusive.

After the 1970's there is a change in the way the problem is perceived. With more married women in continuous employment as an empirical fact, the either career or home formulation became irrelevant. The marriage-career conflict now takes a back seat in research. The typical professional woman in America has an egalitarian marriage that helps her achieve in career; however, the marriage stays because the husband achieves "more." There is no "role" conflict because the professional women are happier and more mature with greater, positive self-concepts, achievement oriented and satisfied with their accomplishments.

What has brought about this shift? Probably both macro changes in society as well as changes at an individual level: (a) motherhood does not occupy as much time as before; there are also more nurseries, day care centres; (b) advanced technology has reduced the physical burden of house-work and also robbed it of much potential for fulfilment and creativity. (If one can buy a good cake, why bother to make it?); (c) growing concern in society with self-development.

At idea level, the earlier fear of maternal deprivation and its dire consequences for children gave way to accepting the "working mother" as no obvious ill-effects attends this phenomenon.

Secondly, old ideas about masculinity, femininity and anxiety regarding masculine/feminine identity came increasingly under attack under the new ideas of androgyny. It began to be realised that the older masculine/feminine traits had been formulated in a psycho-pathological way. We have today more balanced views regarding these.

Methodologically different kinds of subjects had been clubbed together in the comparisons between "career women" and "housewives." Recent research no longer regards the professional woman as deviant or as having psychological problems but as part of a new social milieu. What is now beginning to be questioned is the existing unequal work distribution between different members of the family which creates a strain for the professional woman. Perhaps a similar trend is visible in India.

In as much as the "dual career" families are a new generation with no precedents, social research and social solutions have to come to grips with it.

### **Conclusions**

There has been a change in perspective over the years. On the problems confronting women in science, researchers' understanding is still unsure and riddled with contradictions. There are still different positions between which the analysis moves:

1. Women are not in science in enough numbers because they opt out. The reasons presumed are: (a) psychological conditioning regarding gender identity and gender appropriate behaviour; (b) the opting out, though unfortunate is a realistic appraisal of life-chances and life-styles available to women. The circularity creeps in, again and again, because the context is totally ahistorical.
2. As for the second question on why women who do enter science fare poorly as compared to men, the attempted explanations are: (a) women are not psychologically tuned to science and its demands because they have not been trained that way; (b) the institutional framework hides discrimination within a supposedly equal-opportunity facade. This lies not in any deficiency of women but denial of the type of opportunities for achievement on which rewards are based.

This raises the question, why are they denied these opportunities? The position of women in the family and the workplace is problematic for women. It is this deeper, underlying structure that needs analysis.

## NOTES

Petition to the U.S. Patent Office:

"There has been organised under the auspices of the Women's National Industrial League of America, a new department, whose object it is to promote and encourage the interest of female inventors of the world, many of whom possess the genius and capability of our best male inventors, but who lack the encouragement of an interest on their behalf, an interest which heretofore has been partially, if not wholly neglected. It needs but this lively interest to develop in the women, the tact, the skills, the genius, the capability and the interest in mechanical and other arts from which they have been heretofore practically ostracised. However, in the few years it will be found that the advance strides of women in the various arts have been wonderful and this without any encouragement. What would be their advance with every encouragement of their interest?"

### Select References of Work on Educated, Employed, Middle-class Women

Blumberg, Rhoda and Dwarki, Leela (1980): "India's Educated Women – Options and Constraints", New Delhi: Hindustan Publication.

(This is the revised edition of Rhoda Goldstein's earlier work, "Indian Women in Transition – A Bangalore Case Study, New Jersey: Scarecrow Press, 1972).

Chakravarty, K. (1978): "Conflicting Worlds of Working Mothers – A Sociological Inquiry", Calcutta: Progress Publication.

Hate, C.A. (1969): "Changing Status of Women in Post Independent India", Bombay: Allied Publication.

Kala Rani: "Role Conflict in Working Women in India", New Delhi: Vikas Publication.

Kapur, Promilla (1970). "Marriage and the Working Women", New Delhi: Vikas Publication.

Mehta, Rama (1970): "The Western Educated Hindu Women", Bombay: Vikas Publication.

Mies, Maria (1980): "Indian Women and Patriarchy-Conflicts and Dilemma of Students and Working Women", New Delhi: Concept Publication.

Ramanamma, A (1979): "Graduate Employed Women in an Urban Setting", Pune: Dastana Ramchandra & Co.

Sethi, Rajmohini (1976): "Modernisation of Working Women in Developing Societies", New Delhi: National Publication.

Srivastav, Vinita (1978): "Employment of Educated Married Women in India", Delhi: National Publication.

Wadhera, Kiran (1976): "The New Bread Winners", New Delhi: Viswa Yuvak Kendra.

## REVIEW STUDIES

Agnew, Vijay (1977): "A Review of the Literature of Women", *Journal of Indian History*, Vol. 55, Nos. 1-2.

Choudhry, Maitreyi (1982): "Sociology and Studies on Women", *Social Scientist*, Vol. 10, No. 10, (October).

Desai, Neera and Anantram, Sharayu (1982): "Review of Studies on Middle-Class Women's Entry into the World of Work", Golden Jubilee Symposium, "Women, Work and Society", New Delhi: Indian Statistical Institute.

- Leonard, Karen (1979): "Women in India, Some Recent Perspective", *Pacific Affairs*, Vol. 52, No. 1.
- Mazumdar, Vina and Sharma, Kumud (1979): "New Perceptions in Women Studies", *Economic & Political Weekly*, (20 January).
- Papanek, Hanna (1977): "Women in South and South-East Asia:", Issues and Research, "Social Change", (March).

#### REFERENCES

- Ahmad, Karuna (1973-74): "Women Teachers: Background Study for ICSSR", (unpublished).
- Ahmad, Karuna (1979): "Studies of Educated Working Women in India – Trends and Issues", *Economic and Political Weekly*, Vol. XIV, No. 33, (18th August).
- Ahmed, Karuna (1984): "The Trishankus – Women in the Professions in India", *Sociological Bulletin*, Vol. 33, No. 1 & 2, (March-Sept.).
- Amram Fred (1984): "The Innovative Woman", *New Scientist*, Vol. 14, No. 11, (24th May).
- Andharia, Janaki (1983): "Husband's Role Expectations of Their Wives; Masters Thesis", Tata Institute of Social Sciences.
- Begum J. Roshan and Balaraman, Kamala (1915): "Contemporary Sociological Problems of Women Engineers and Scientists in India", Paper presented to the Fourth International Conference of Women Scientists and Engineers, Poland.
- Bhargava, G. (1982): "Professional Identification of Women Medical Students in India – A Study of Six Differences", *Sociological Abstracts*, Vol. 30, (August-December).
- Blackstone, Tessa and Weinreich, Helen (1980): "Why are There so Few Women Scientists and Engineers?", *New Society*, (21st February).
- Chakravarty, Radha, Chawla, Anju and Mehta, Geeta (1984): "The Status of Women Scientists in India", New Delhi: National Institute of Science, Technology and Development Studies.
- Chitnis, Suma (1975): "Traditional Stereotypes and Roles of Women", Bombay: Unit for Research in the Sociology of Education, Tata Institute of Social Science, Study sponsored and founded by ICSSR.
- Cole, Jonathan (1979): "Fair Science: Women in the Scientific Community", New York: Free Press.
- Cole, Jonathan (1980): "Meritocracy and Marginality", Keynote address to Radcliffe College, U.S.A.: Harvard University, (April).
- Daftary, Sharayu (1976): "Women Managers", *Indian Management*, Vol. 15, No. 5.
- Ehrenreich, Barbara and English, Deirdre (1973): "Witches, Midwives and Nurses", New York: Old Westburg, The Feminist Press.
- Feldman, Jacqueline (1973): "The Savant and the Midwife", *Impact of Science on Society*, Vol. XXV, No. 2.
- Ferry, Georgina and Moore, Jane (1982): "True Confessions in Science", *New Scientist*, (1st July).
- Fourth International Conference on "Women Scientists and Engineers", Poland: Gacow, (1975).
- Ghadially, Rehana (1977): "Career Oriented and Non-Career Oriented College Women", *Journal of Social Work*, Vol. 38, No. 1.
- Ghadially, Rehana and Verma, R. (1980): "A Comparative Study of Men and Women in Science and Engineering", *Bombay Psychologist*, Vol. 2, (April).
- Gupta, Manju (1979): "A Study of Job Satisfaction Among Women Workers", *Indian Journal of Industrial Relations*, Vol. 13, No. 3, (January).

- Harding, Jan (1983): "How the World Attracts Girls to Science", *New Scientist*, (15th September).
- Indian Women Scientists Association (1975): "First All India Meeting in Science", Bombay, (27-28 December).
- Indian Working Women's New Horizons in *Monthly Public Opinion Survey*, Vol. XII, No. 11-12, (August-September).
- Jackson, Daphne (1980): Reply to "Why are There So Few Women Scientists and Engineers?" *New Scientist*, (6th March).
- Jaiswal, R.P. (1981): "Status of Working Men and Women Engineers", An Analysis Based on Fifty Engineers in Kerala, Bombay: Paper presented at the First National Conference of Women Studies, SNDT Women's University, (April).
- Kala Rani (1976): "Performance of Job Roles by Working Women", *Indian Journal of Social Work*, Vol. 37, No. 3.
- Kanekar, S. and Kosawalla, M.B. (1917): "Responsibility in Relation to Respectability", *Journal of Social Psychology*, Vol. 102 (August).
- Kapur, Promilla (1970): "Marriage and the Working Women", New Delhi: Vikas Publications.
- Kapur, Rama (1969): "Role Conflict Among Employed Housewives" *Indian Journal of Industrial Relations*, Vol. 5, No. 1, (July).
- Kelly, Abson (1981): "The Missing Half- Girls and Science Education", Bolton, Greater Manchester, England: Manchester University Press.
- Kohlstead G. Sally (1978): "In from the Periphery: American Women in Science 1830-1880", *Signs*, Vol. 4, No. 1, (Autumn).
- Krishnaraj, Malthreyi (1982): "Review of Recent Research on Women and Work", *Golden Jubilee Symposium on Women and Work*, Indian Statistical Institute.
- Mahajan, Amarjeet (1966): "Women's Two Roles: A Study of Role Conflict", *Indian Journal of Social World*, Vol. 24, No. 4.
- Mhatre, Sharayu (1978): "Women in Bankng", NIBM. Bombay: (unpublished paper).
- Mattfield, Jacqueline and Van, A. Carol (Eds.) (1965): "Women in the Scientific Profession", Cambridge, Massachusetts, U.S.A.: MIT Press.
- Meyer Dennis, Geraldine (1955): "The Scientific Lady in England 1650-1760", Berkeley, U.S.A.: University of California Press.
- Misra, Rajendra (1977): "Working Women - A Frame of Reference", *Indian Journal of Social Research*, Vol. 18, Nos. 2 & 3.
- Report of the Women in Science Workshop to the National Science Foundation (1977), Denver: University of Colorado, (October).
- Rossiter, Margaret (1974): "Women Scientists in America Before 1920", *American Scientist*, Vol. 62, (May-June).
- Selcox M. I (1980): "Reply to Jackson", *New Scientist*, (6th March).

- Shankaran, Uma (1981): "Study of Sex Role Differences in the Indian Banking Industry", *Human Features*, Vol. 4, Nos. 2-3, (Summer, Autumn).
- S.N.D.T. Women's University and Indian Women Scientists Association (1975): "Women Scientists - The Employed Middle-class Woman as a Conundrum — A Preliminary Study", (unpublished).
- Srivastav, Vinita (1977): "Professional Education and Attitude to Female Employment", *Social Action*, Vol. 27, No. 1.
- Stein, Sandra and Lockheed Marlaine (1983): "Women's Studies and Men's Careers", *Women's Studies International Forum*, Vol. 6, No. 2.
- Surti, Kirtida, (1981): "Role Stress, Role Efficacy, and Coping Styles in Working Women", Ahmedabad: IIM.
- Tosi, Lucia (1975): "Women's Scientific Creativity", *Impact of Science on Society*, Vol. XXV, No. 2.
- UNESCO (1982): "International Congress on the Situation of Women in Technical and Vocational Education", Bonn, FRG. (9, 12 June).
- Visalakshi S., Quereshi M.A., Gupta S.P. (1983): "Dimensions of Science and Technology Prizes: An Overview of the Indian Reward System". *Journal of Scientific and Industrial Research*. Vol. 42. (December).
- Vitter, Betty (1981): "Women Scientists and Engineers.—Trends in Participation", *Science*, Vol. 214, No. 18.
- Wasi, Muriel (1972): "The Professional Women in India: Dangerous Corners". *Monthly Public Opinion Surveys*, Vol. 18, No. 1.
- Yogev, Sara (1983): "Judging the Professional Women, — Changing Research Changing Values", *Psychology of Women Quarterly*, Vol. 7, No. 3, (Spring).

# 4

## Indian Women Enter Science

This chapter traces the growth and development of science education for women after Independence. It sets out the rate of growth in enrolment, their representation in different disciplines and their aptitude for science as revealed by examination performance. It also presents national level data on the patterns of employment and unemployment of the science qualified women.

### ENROLMENT AND PERFORMANCE

Higher education for women began in India when Calcutta University threw open its doors to women candidates in 1877 and in 1883 we had our first two women graduates. In the period between 1881 to the eve of India's Independence, progress in women's education continued at a halting pace. Thus, in 1947 in six major universities of India we had 23,000 women but they constituted barely 0.5 per cent of all the girls in the education system as a whole (Sen 1969).

After Independence women made a spectacular progress in higher education. In 1980 we had 6,89,402 women in the higher education system, an increase of 18 times over 1947. The fastest growth was registered between 1960-65: 119.4 per cent, when the overall rate for all persons was 85 per cent; in the seventies, the rate of growth for women was 75 per cent when the overall rate for all persons was only 61 per cent and in the late seventies and early eighties growth in women's higher education had slowed down further to 25 per cent (Kaul 1974).

Rapid development of higher education for women is by no means a unique phenomenon. According to the U.N. Statistical Year Book (1980), in the last three decades women's educational opportunities increased dramatically in many parts of the world, especially in university education and professional education. In 1970 women in the university system were 55 per cent in the Philippines, 51 per cent in U.S.A. and over 45 per cent in Eastern



Europe and U.S.S.R. In the majority of European countries, the number of female university students doubled or tripled during 1960-70. In African, Asian and Latin American countries, the number of women university students had risen from an initial level to 7-16 times within a decade.

**Table 4.1**  
**FEMALE SHARE OF TOTAL ENROLMENT (1970)**

(Percentage)

Region	Primary	Secondary	University
North America	49.4	48.8	41.2
Asia	38.1	34.8	27.7
Oceania	47.6	44.0	30.3
U.S.S.R	49.0	54.8	49.0
Europe	48.7	47.1	35.5
Africa	39.7	32.2	25.9
Latin America	48.6	48.4	35.4
World	43.6	43.4	38.0

Source: U.N. Statistical Year Book (1980).

What is unique in the case of India (and some other Third World countries) is that this growth in university level education is not matched by expansion of female literacy or primary education for the country as a whole.

**Table 4.2**  
**GROWTH RATE PERCENTAGE (LEVELS OF EDUCATION)**

	1960-61 to 1965-66	1965-66 to 1970-71
Primary Education	50	30.7
Secondary Education	70	30.5
University Level Education	119	78.4

Source: University Development Facts and Figures, University Grants Commission.

Barring a few advanced countries, Indian universities absorbed a greater proportion of secondary school leavers.

**Table 4.3**  
**ENROLMENT IN UNIVERSITIES AS PER CENT OF DIFFERENT LEVELS OF**  
**SCHOOL LEAVERS**

<i>Country</i>	<i>Primary</i>	<i>Secondary</i>
India	5	15
Indonesia	0.6	2.3
Burma	1.0	4.9
Pakistan	4.0	10.6
U.K.	7.0	10.3
West Germany	7.3	10.2
U.S.A.	21.4	38.4
Canada	11.7	34.0
U.S.S.R.	10.8	50.3

Source: Ibid.

Among those pupils who manage to get to secondary level are many who go all the way up. Our educational pyramid has a narrow base. That our progress in women's higher education is not matched by growth of female literacy is a sad commentary on the bias in the education system (Census of India 1981). During 1951 to 1981, female literacy grew very slowly.

**Table 4.4**  
**PROGRESS OF LITERACY IN INDIA: 1901-1981**

	<i>Male</i>	<i>Female</i>	<i>Percentage Rate of Growth in Female Literacy</i>
1901	9.83	0.60	—
1911	10.56	1.05	74
1921	12.21	1.81	72
1931	15.59	2.93	61.8
1941	24.90	7.30	149.0
1951	24.95	7.93	14.4
1961	34.44	12.95	63.3
1971	39.45	18.69	44.3
1981	46.74	24.88	33.1

Source: Census of India — 1981.

In Appendixes I, II and III at the end of this chapter we have put together data on women's enrolment in higher education for three decades. We can see the relative progress of women in science at a glance. Between 1949-50 to 1964-65 the proportion of women in all faculties increased from 10.2 per cent to 21.4 per

cent; the proportional representation of women in science jumped from 6 per cent to 18 per cent. During subsequent years the gain registered in all faculties was 5 per cent but in science, their representation climbed to 24 per cent.

However, with the exception of medicine, women's enrolment in other professional courses of science was modest. Even in medicine, women formed 23 per cent in the sixties but declined to 21 per cent in the late seventies.

**Table 4.5**  
**COMPARATIVE PROGRESS IN SCIENTIFIC EDUCATION FOR**  
**MEN AND WOMEN: 1949-50 to 1975-76**

	General Science		Professional Science		Engineering/Tech.	
	Men	Women	Men	Women	Men	Women
1949-50	1,15,718	1,627	17,131	2,242	10,387	27
1975-76	3,52,137	1,11,714	1,21,946	19,731	94,006	2,061
Total						
Increase %	423	6,766	612	320	810	7,174
Average Yearly Increase	16.3	260.0	23.5	12.3	31.2	275.0

Women have entered science in significant numbers and done so rapidly after Independence, but even so there is continued preference for arts and education and other traditional subjects. After 1970 commerce has been attracting women as much as men. We notice that after a peak in the sixties, growth in science enrolment was 4 per cent, for commerce 24 per cent, education 11 per cent, arts 8 per cent and law 20 per cent.

**Table 4.6**  
**DISCIPLINE REPRESENTATION OF WOMEN IN HIGHER EDUCATION:**  
**1950-51 to 1978-79**  
**(Per cent of Women to Total Enrolment)**

<i>Discipline</i>	<i>1950-51</i>	<i>1955-56</i>	<i>1960-61</i>	<i>1965-66</i>	<i>1970-71</i>	<i>1978-79</i>
Arts	16.1	18.3	24.6	31.5	31.7	37.0
Science	7.1	8.4	10.5	17.1	17.3	27.5
Commerce	0.6	0.6	0.9	1.8	3.7	13.2
Education	32.4	29.8	32.8	34.7	36.5	47.3
Eng./Tech.	0.16	0.19	0.89	0.97	1.0	3.7
Medicine	16.38	18.1	21.9	23.9	22.8	21.8
Agriculture	0.17	0.29	0.45	0.16	0.4	2.8
Vet. Science	0.45	0.39	0.71	0.62	0.7	2.7
Law	2.1	1.7	3.0	3.4	3.7	6.2
Others	18.8	24.2	26.8	33.2	40.0	38.8

Source: University Grants Commission.

The annual compound growth in different faculties between middle sixties and seventies-eighties was in per cent terms: arts: 6.2; science: 4.1; commerce: 24.0; education: 11.8; engineering-technology: 1.8; medicine: 4.5; agriculture: 13.1; law: 19.2; veterinary science: 2.0; others: 2.2.

Out of total women in higher education, more than 60 per cent go for arts, whereas only 40 per cent of boys do so, but the per cent of girls in science out of total girls in higher education compares not too unfavourably with the boys. For girls it is 24.7 per cent while for boys it is 28.7. There is a higher proportion from among the boys going in for commerce, medicine, engineering-technology and agriculture than girls.

We give below the stagewise enrolment of women at university level and we see that the representations at different levels are not that far apart.

**Table 4.7**  
**WOMEN'S ENROLMENT AS PER CENT OF TOTAL ENROLMENT —**  
**STAGEWISE: 1969-70 to 1979-80**

<i>Year</i>	<i>Graduate</i>	<i>Post-graduate</i>	<i>Research</i>	<i>Diploma/Certificate</i>
1969-70	21.8	24.5	18.8	22.7
1970-71	21.7	25.8	20.7	23.3
1971-72	22.2	25.5	20.7	24.1
1972-73	—	—	—	—
1973-74	23.2	25.1	22.0	21.6
1974-75	23.3	23.7	22.8	22.7
1975-76	24.5	24.9	24.4	23.4
1976-77	—	—	—	—
1979-80	26.0	27.1	24.8	23.4

Source: Ibid.

What kind of subjects do women opt for within science? We do not have data on this for consecutive years but available data shows a concentration of women in the bio-sciences. This appears to be so even in the advanced countries such as the U.K.

**Table 4.8**  
**M.Sc. ENROLMENT: SEX-WISE AND SUBJECT WISE BREAK-UP: 1979-80**

<i>Subjects</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>	<i>% Women to Total</i>
Physics/Applied Physics	6,363	1,406	7,769	18.09
Chemistry/Applied Chemistry	9,129	3,037	12,166	24.98
Mathematics/Applied Mathematics	7,051	1,880	8,931	21.05
Biological Sciences	475	219	694	31.56
Statistics/Applied Statistics	1,625	401	2,026	19.79
Botany	3,835	1,930	5,765	33.49
Zoology	4,015	2,197	6,212	35.38
Geology	623	298	921	32.35
Home Science	—	1,296	1,296	100
Micro Biology	296	181	477	37.95
Bio-Sciences	528	310	838	37
Anthropology	202	154	356	43.26
Others*	721	244	965	25.28
<b>Total</b>	<b>36,587</b>	<b>13,662</b>	<b>50,249</b>	<b>27.19</b>

\* Includes biometry, criminology, industrial fisheries, psychology genetics, military science, marine science, etc.

Source: Government of India (1981). Report of the Working Group on Personnel Politics for the Greater Involvement of Women in Science and Technology. Ministry of Social Welfare.

**Table 4.9**  
**M.Sc. ENROLMENT: SEX-WISE AND SUBJECT-WISE BREAK-UP IN**  
**THE U.K.**

	% All Boys	% All Girls
Maths	41	15
Physics	41	9
Biology	16	21
Other Subjects	2	55

Source: D.E.S Education Survey, quoted in *New Society*, 21 February 1980.

**Table 4.10**  
**RESEARCH ENROLMENT IN SCIENCE: SEX-WISE AND SUBJECT-WISE**  
**BREAK-UP: 1970-80**

Subject	Men	Women	Total	% Women to Total
Physics/Applied Physics	1,409	263	1,672	16.27
Chemistry/Applied Chemistry	2,179	586	2,765	21.19
Mathematics/Applied Mathematics	769	143	912	15.68
Statistics/Applied Statistics	236	35	271	12.91
Biological Sciences	260	92	352	26.13
Botany	1,234	481	1,715	28.05
Zoology	1,068	384	1,452	26.45
Geology/Geo-physics	490	22	512	4.33
Geography	173	90	263	39.22
Home Science	3	64	67	27.94
Bio-Science	167	81	248	32.66
Anthropology	59	61	120	50.08
Others*	327	71	398	20.35
Total	8,444	2,400	10,844	22.13

Source: Report of the Working Group *op. cit.*

It is heartening to see women making small dents in engineering/technology also.

**Table 4.11**  
**WOMEN'S ENROLMENT IN 5 IITs**

<i>Year</i>	<i>B.Tech</i>	<i>M.Tech</i>	<i>M.Sc.</i>	<i>Ph.D/Eng.</i>	<i>Total</i>
1978	101	41	131	24	297
1980	106	73	134	148	461

*Source:* Report of the Working Group, *Op. cit.*

Are girls good at science? There is a common feeling that science is a difficult subject and that girls avoid it in favour of "softer" subjects. We have no basis for this assertion as we do not have proper studies to assess the relative performance and aptitudes of girls and boys in science. Figures of enrolment deal with the situation of *fait accompli* — we have no way of knowing potential loss to science.

Education in India publishes pass percentage of girls and boys. Though the coverage is very uneven, we have put together broad categories and presented them in the appendix. Girls perform consistently better than boys in examination.

The NCERT conducts Science Talent Competitive Examinations but their reports do not give sexwise breakdowns of applicants. We had only mention of girls in the awardee lists. They were 20.9 per cent among the awardees and 20.40 per cent among the recipients of certificates (Saxena 1964). This does not tell us about the proportions of boys and girls who were successful from the total candidates in each category.

In an evaluation done by an international association, which rated student performance in the science curriculum, through standardised scores (i.e., expressed as the number of standard deviation above and below mean), India did not do as well as First World countries or even some Third World countries but India was one of the few countries where there was no difference in performance between girls and boys (Comber and Keeves 1923). (also see Appendix 3).

We have no national level data on wastage in science education but Kamat's (1963) study may be taken as indicative that girls persist in the course, once they are in. He found that the dropout rate for girls was 32 per cent against 42 per cent for boys, a phenomenon contrary to the high dropout of girls at primary level. Kamat found a distinct caste difference in dropouts; among the lower castes it was 50 per cent higher than among the higher

castes. He also did not notice any difference in marks between girls and boys. He found instead a higher proportion of high-scoring girls in SSC among the arts groups, which means that while most of the high-scoring boys go in for science, most of the high scoring girls do not do so. Choice is influenced by various social considerations.

The CSIR records of foreign qualified women in the Scientists Pool shows that many more women now obtain foreign degrees in science subjects than before (CSIR 1982).

**Table 4.12**  
**FOREIGN QUALIFIED WOMEN IN SCIENTISTS' POOL**

	1958-70	1971-80	1958-80
Science	34.9	46.9	40.3
Eng./Tech.	5.0	4.7	4.8
Medicine	56.5	44.4	51.1
Social Sciences	3.6	4.0	3.8
Total	100.0	100.0	100.0
No. of Women	584	473	10.57

Source: *Science Manpower Journal*, Vol. XV, No. 3, Oct.-Dec. 1979.

**Table 4.13**  
**WOMEN STUDENTS GOING ABROAD**

Year	All Faculties		Science/Technology		Arts/Humanities	
	W	% Total	W	% Total	W	% Total
1965-66	352	7	157	4	195	19
1966-67	749	13	321	7	428	29
1967-68	283	6	115	3	168	21
1968-69	720	13	223	5	497	42
1969-70	209	5	95	3	114	15
1970-71	281	6	129	3	152	15
1971-72	245	8	130	6	115	12
1972-73	366	11	185	9	181	16
1973-74	640	10	509	13	131	5
1974-75	409	10	302	10	107	8
Total	4254	9	2166	6	2088	17

Source: *Ibid.*



Among the women who went abroad for further training in the sciences, women in nursing and medicine were more. During 1970-75, women were a small fraction of the science qualified persons going abroad.

**Table 4.14**  
**STUDENTS GOING ABROAD**

<i>Subjects</i>	<i>Men</i>	<i>Women</i>
Nursing	109	753
Science	2904	266
Medicine	7159	57
Eng./Tech.	3426	173
Agriculture	230	6
Total	13828	1255

### **General Conclusions Regarding Science Education and Women**

We have assembled somewhat scrappy and uneven data from different sources. In overall terms, there is striking progress but many deficiencies remain to be overcome to obtain equal status. Women cluster in a limited range of disciplines and do not get as much opportunity for higher training. The biggest deficiency which takes away much of the euphoria is that less than 3 per cent Indian women have access to college education.

To quote Shankar Narayan (1981), "Although women's institutions have increased in number, it is nevertheless obvious that most education takes place within a system that was developed for men and that has only been marginally adopted to accommodate the entry of women. Exclusive women's colleges and women's universities have done no better than to reinforce and rigidify the prevailing stereotypes and even differential treatment of women students, curricula, text books, classification of subjects and unwritten code of conduct". He advocates many more middle level training opportunities.

### **SCIENCE EDUCATED WOMEN AND THEIR EMPLOYMENT PICTURE**

National profiles of science educated women are available in the special volumes of 1961 and 1971 relating to degree holders and technical manpower. There are other official reports that give some data. Though these different sets of data are not strictly

comparable because of various differences in definition and scope, we have adjusted them to provide some estimates, however crude. We examine the total available stock (as distinct from yearly enrolment) employment and unemployment, type of employment etc. In 1980 according to estimates of department of science and technology there were 3,35,775 women.

**Table 4.15**  
**STOCK**

(= 14.0 per cent of total stock)

	1961			
	Persons	Men	Women	Women as % T
Scientific*	1,17,943	1,06,928	11,015	9.3
Engineering/Technical	83,116	82,545	571	0.7
Medical	44,307	39,885	4,422	10.0
Total	2,45,366	2,29,358	16,008	6.5

Source: 1961, Census Monograph on Scientific and Technical Personnel.

	1971			
	Persons	Men	Women	Women as % T
Scientific*	4,47,991	3,66,738	81,253	18.1
Engineering/Technical	1,01,751	1,00,445	1,306	1.2
Medical	74,572	59,596	14,976	20.2
Total	5,26,779	97,535	97,535	15.6

\* Excludes medicine. (Definition and coverage were different: we have re-adjusted the figures). Levelwise, women scientific personnel excluding medicine improved.

Source: 1971, Census Vol. 7, G. Series, Degree Holders and Technical Personnel.

**Table 4.16**  
**SOURCE OF SCIENTIFIC PERSONNEL**

(Excludes Medicine)

	1961		1971	
	All	Was % T	All	Was % T
Post-graduate	19	7.5	21.6	15.3
Graduate	81	10.0	78.4	17.2
Total	100		100	

If we include all scientific personnel including medicine etc., there is still a somewhat higher proportion of doctorates and post-graduates among men in 1971.

**Table 4.17**  
**DISTRIBUTION OF SCIENTIFIC PERSONNEL BY LEVEL**

	Men	Women
Doctorates	1.8	0.8
Masters	20.2	18.6
Bachelors	77.5	79.7
Diploma/Certificates	0.4	0.9
Unspecified	0.1	—
Total	100.0	100.0

**Table 4.18**  
**DISTRIBUTION OF DEGREE HOLDERS AND TECHNICAL PERSONNEL IN EACH SUBJECT FIELD IN INDIA, 1971**

Subject Field	Total Qualified Persons		Qualified Females as % of Total Qualified Persons
	Male	Female	
Arts/Humanities	8,43,606	2,96,083	25.9
Commerce	1,68,023	3,898	2.3
Agriculture and Veterinary Science	50,038	598	1.2
Science	3,68,544	81,813	18.2
Engineering and Technology	2,46,049	3,549	1.4
Medicine (Allopathy)	55,035	13,262	19.4
Medicine (Others)	20,026	2,769	12.2
Nursing	410	3,377	89.2
Technical/Vocational Trade	18,436	1,158	5.9
Others	11,135	2,423	17.9
Total	17,81,302	4,08,930	18.7

Source: Census of India 1971, Series I. Vol. VII(I), Table G I.

**Table 4.19**  
**ESTIMATED STOCK OF WOMEN SCIENTISTS IN INDIA (1975)**

<i>Subject</i>	<i>Total Stock (M + F)</i>	<i>Women Scientists</i>	<i>Women as % T</i>
Agriculture	24,536	150	3.6
Botany	23,693	6,800	28.7
Chemistry	53,632	6,000	11.2
Physics	39,336	2,600	6.6
Mathematics	59,653	6,100	10.2
Statistics	8,769	670	7.6
Geology	9,300	90	0.9
Geography	22,514	3,360	14.95
Zoology	23,092	6700	29.03
Psychology	15,745	7,100	45.72
Home Science	1,431	1,360	95.11
Science (Others)	3,626	870	24.0
<b>Total</b>	<b>2,58,327</b>	<b>41,800</b>	<b>14.6</b>
Medical Graduates		29,780	
Post-graduates in Medicine		8,160	
Engineering Graduates		3,100	
Post-graduates in Engineering		530	

*Source:* Roy, S.K. (1975): *Women Scientists of India*, S.N. Gandhi and J.S. Nigam, Vigyan Pragati (CSIR) Aug-Sep.

We see the concentration in bio-sciences for women. Age distribution of scientists shows that for both men and women, the majority are below 35 but there are fewer women in the older age groups suggesting later entry of women.

### **Employment Pattern**

Both in 1961 and in 1971, the public sector was the major employer but among the women a smaller percentage were in public sector.

In 1961 school teaching accounted for jobs for 63.4 per cent women but only 24.0 per cent among men: 8 per cent of the women went in for college teaching but only 4 per cent of the men did so. The pattern of employment for women has not changed much. It is clear that private sector industry does not welcome women.

**Table 4.20**  
**EMPLOYMENT OF MEN AND WOMEN BY DISCIPLINE AND TYPE OF ORGANISATION**

	<i>Science</i>		<i>Arts/Humanities</i>	
	<i>Men</i>	<i>Women</i>	<i>Men</i>	<i>Women</i>
Universities	7.0	10.0	3.0	4.0
Polytechnics	0.03	0.03	0.01	0.01
Schools	23.0	39.0	38.0	62.0
Private Coaching	0.01	0.02	0.01	0.3
Natural Resources	0.09	0.01	0.02	negligible
Social Welfare	0.08	0.008	0.01	0.08
Public Sector Industry	3.05	0.01	2.0	1.0
Private Sector Industry	10.00	25.0	41.0	19.0
Other Government Organisations	35.00	0.02	3.0	3.0
Others	15.00	18.00	9.0	9.0

*Source:* 1971 Census — Compiled from G.Series. (Total do not exactly add up to 100.0 because of fractions).

A cohort study done by CSIR at CSIR itself in 1980 shows the inadequate representation of women at higher levels, particularly decision making levels.

This is not unique to R & D organisations only. In Central Government the distribution of women employees were as follows:

**Table 4.21**  
**STOCK**

*(Figs. in thousands)*

<i>Class I</i>	<i>Class II</i>	<i>Class III</i>	<i>Class IV</i>
251	269	41.75	84

*Source:* Ministry of Labour (1975), Women in Public Sector.

An Andhra Pradesh study of public enterprises shows that this is typical in most places. The representation of women at executive level was 25 per cent, at technical level 15.8 per cent, at assistant's level 19.5 per cent but at receptionists' level 100 per cent, steno-typist level 60 per cent, telephone operators' 28.5 per cent, attendants' 19.0 per cent, sweepers' 12.0 per cent and daily wage earners 97 per cent (Vanamala 1983).

The allocation of work within R & D also indicates a mal-distribution. Women were 6 per cent of total in R & D organisations, but more than 50 per cent were in administration doing non-scientific work. Only 25 per cent were engaged in actual research work (Government of India 1980).

**Table 4.22**  
**WOMEN IN R & D**

	<i>Engaged in R &amp; D</i>	<i>Auxiliary Work</i>	<i>Admn. Work</i>	<i>Total</i>
Central Govt.	2,356	2,224	4,057	8,637
State Govt.	295	157	533	987
Private	341	148	261	750
Total	2,992	2,529	4,853	10,374

### Salary Levels

Salary levels are consistently lower than that of men and also show declines over a period of time according to 1971 Census.

**Table 4.23**  
**SALARY LEVELS**

<i>Monthly Salary in Rs.</i>	<i>% Men</i>	<i>% Women</i>
Less than 100	0.20	4.80
100- 499	46.8	64.50
500- 999	27.1	16.50
1000-1999	7.2	1.45
2000 +	1.4	0.16

Source: 1971 Census, G. Series.

**Table 4.24**  
**SALARY DIFFERENTIALS IN ALL INSTITUTIONS**

	<i>25-29</i>	<i>30-34</i>	<i>35-39</i>	<i>40-44</i>	<i>45 +</i>	<i>All Ages</i>
Women's earnings as % of Men's	94	87	82	79	78	66

(See details – Appendix)

Source: Nair, P.S. et. al (1978); "Post-graduate Women Scientists" CSIR.

### Wastage of Science Education

The unemployment level among women scientists tended to be twice as high as that of men. The 1971 Census gave details by disciplines.

**Table 4.25**  
**WASTAGE OF SCIENCE EDUCATION**

	<i>Per cent Unemployed</i>		
	<i>All Persons</i>	<i>Men</i>	<i>Women</i>
Post-graduate	25.1	4.1	8.6
Graduate	41.6	8.2	15.1

Source: Census Monograph, 1961, *Op. cit.*

**Table 4.26**  
**UNEMPLOYMENT AMONG DEGREE HOLDERS IN DIFFERENT DISCIPLINES**

	<i>Among Degree Holders Unemployment as % Total Qualified Persons</i>		<i>% Unemployment Trying for Job</i>	
	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>
Arts/Humanities	11.8	43.9	11.7	55.2
Commerce	14.9	28.1	8.4	40.3
Agriculture/Veterinary Science	9.8	17.6	8.2	19.9
Science	16.2	42.3	7.5	48.6
Engineering/Technology	13.0	28.5	4.6	19.4
Medicine (Allopathy)	4.2	8.4	13.9	29.1
Medicine (Others)	6.6	16.9	23.5	34.0
Nursing	4.6	7.7	26.3	54.8
Technical/Vocational Below degree level	20.2	46.8	4.4	18.5
Others	8.3	37.5	13.41	53.2
Total	13.89	41.6	9.21	53.1

Source: Census 1971, *Op. cit.*

We have no recent figures of unemployment. According to the report of the Department of Science and Technology, the overall unemployment among science graduates (men and women) was 20.57 per cent among graduates and 4.87 among post-graduates.

In the different fields unemployment varied, highest being among engineers (19.88 per cent) followed by (14.9 per cent) for both B.Sc. degree holders and B.Ed. degree holders. In medicine it was 6.5 per cent, agriculture 11.4 per cent and veterinary science 3.6 per cent. This suggests the extent of mismatch between the job market and the turnout from the education system. The fate of women is worse.

In conclusion, Indian women have entered science in an impressive way but are concentrated in some disciplines only in a preponderant way; though the absolute numbers in science are large, as a proportion of total female enrolment, science is way behind arts and education which most women continue to prefer. A sizable proportion of science trained women are unemployed and of those employed, the majority are in a narrow range of occupations, (mostly teaching and research). Salary and post wise, national data show an unsatisfactory picture for women.

### **Some International Comparisons**

The U.S. Experience (Vitter 1983) indicates a growing strength in science/engineering but continued concentration in life sciences. Women were concentrated at lower levels and crowded into teaching. The more number of years they put in, the greater the loss for them as salary differentials widened with increasing number of years of work.

**Table 4.27**  
**NUMBER OF SCIENCE AND ENGINEERING DOCTORAL DEGREES AWARDED**

Year		All Scs. Engrn.	Phys. & Scs.	Engrn.	Maths & Scs.	Life Scs.	Social Scs.
1965	Total	10,477	2,865	2,073	685	2,539	2,315
	Women	744	127	7	50	263	297
	W % T	7.10	0.78	0.33	7.29	10.35	12.82
1980	Total	18,171	3,151	2,479	963	5,325	6,253
	Women	4,099	386	90	116	1,342	2,165
	W % T	22.5	12.2	3.63	12.0	25.20	34.62

Source: Vitter, Betty (1983): *Science*, Vol. 18.



**Table 4.28**  
**EMPLOYMENT SECTOR OF DOCTORAL SCIENTISTS AND ENGINEERS IN**  
**THE U.S.A. (1979)**

Number of Employed		Business		Percentage in Educational Institutions		Government		Hospitals and Clinics	
M	W	M	W	M	W	M	W	M	W
2,79,185	33,150	28.0	13.8	54.5	66.1	10.6	8.6	1.0	4.2

Source: *Ibid.*

**Table 4.29**  
**SALARY DIFFERENTIALS**

	Women's Salaries as Per cent of Men		
	After 4 Years	After 10 Years	After 25 Years
Mathematics	86.9	91.8	66.1
Chemistry	93.5	73.6	68.6
Biology	90.5	78.8	65.6
Engineering	91.9	86.6	78.4

Source: *Ibid.*

The experience of selected socialist countries does not seem to violate the fundamental inequalities, despite larger number of women being in science and technical fields.

**Table 4.30**  
**SHARE OF WOMEN IN SELECTED OCCUPATIONS: USSR,**  
**CZECHOSLOVAKIA, POLAND, YUGOSLAVIA (1970)**

	USSR	Czechoslovakia	Poland	Yugoslavia
Architects	45.4	20.4	23.0	19.8
Medical Doctors	71.7	42.2	50.9	36.6
University Teachers	43.0	34.2	33.7	28.1
Administration (Managerial)	20.6	14.8	27.1	8.8
Clerical	84.9	74.9	60.6	49.2
Metal Processors	68.3	25.2	19.9	11.6
Chemical Processors	72.0	61.9	57.7	44.8
Instrument Makers	9.3	11.9	4.3	4.1
Blacksmith/Toolmakers				
Machine Operators	26.8	21.2	12.8	7.7

Source: *Ibid.* (In the USSR women comprise 50 per cent total personnel in science and research and 31 per cent in engineering).

**Table 4.31**  
**AVERAGE MONTHLY INCOME BY SEX AND LEVEL OF EDUCATION**  
**YUGOSLAVIA (1976)**

(Dinars)

	<i>Ph.D</i>	<i>Masters</i>	<i>Grad.</i>	<i>High Sch.</i>	<i>Primary</i>
Men	8,646	7,316	6,731	4,383	3,355
Women	7,364	6,053	5,584	3,683	3,155
W as % Men	85.1	82.7	82.9	84.0	94.0

Source: *Ibid.*

**Table 4.32**  
**EMPLOYMENT CATEGORY OF MEN AND WOMEN BY SKILL LEVEL,**  
**YUGOSLAVIA (1976)**

	<i>Highly Skilled</i>	<i>Skilled</i>	<i>Semi-skilled</i>	<i>Unskilled</i>
Men	4,587	3,650	3,036	2,871
Women	3,646	2,941	2,550	2,453
W as % Total	44.3	44.4	83.9	85.4

Source: *Ibid.*

**Table 4.33**  
**DISTRIBUTION OF PRINCIPAL RESEARCH PERSONNEL IN THE**  
**HUNGARIAN ACADEMY OF SCIENCES (1979)**

	<i>Total Persons</i>	<i>Women</i>
Director General	2	Nil
Director	43	1
Dy. Director	42	4
Divisional Head	24	Nil
Dy. Head	149	11
Dy. Department Head	14	1
Section Head	93	10
Total	367	27

Source: *Ibid.*

Whatever international data is available, they point to trends similar to the Indian experience, though proportionately speaking, European countries and U.S.A. have more women in science while in Eastern European countries and U.S.S.R. women are represented adequately in the scientific professions. However, certain basic inequalities remain — in discipline representation and in salaries and posts. The gender bias in scientific estab-

lishments appears fairly uniformly though in different degrees all over the world.

Women's responsibilities for housework and child care are not relaxed in any of these societies. This sexual division of labour militates against women pushing ahead in science which requires large investments in time and energy. Some studies such as those of Cole, Vitter, throw light on the in-built male bias in scientific organisations. For U.S.S.R and Eastern Europe we do not have any information.

**Appendix I****Sources used**

Education in India, Min. of Education, Govt. of India.

1949-50;	1950-51;	1951-52;	1952-53;	1953-54;
1954-55;	1955-56;	1956-57;	1958-59;	1959-60;
1960-61;	1961-62;	1963-64;	1964-65.	

The figures in these volumes are given for individual subjects and for different levels. They were regrouped and sub-totals compiled to give a concise picture.

University Government Commission, University Development in India-Series.

<i>Date</i>	<i>Published Year</i>	<i>Date</i>	<i>Published Year</i>
1961-62	1962	1968-69	1972
1962-63	1963	1969-70	1973
1963-64	1964	1970-71	1974
1964-65	1966	1971-72	1976
1965-66	1968	1972-73 to	
1967-68	1971	1975-76	
		Part I. A,B,C,D	1980 &
		Part II. A,B	1981

**Appendix II**  
**Table 1**  
**WOMEN ENROLMENT ACCORDING TO STAGE 1982-83**

Level	University Teaching Departments/ University Colleges		Affiliated Colleges		Total	
	Enrolment	% of Total	Enrolment	% of Total	Enrolment	% of Total
Graduate	61,902	54.1	7,11,440	92.9	7,73,342	87.9
Post-graduate	33,188	33.4	48,142	6.3	86,330	9.8
Research (1)	2,392	2.1	169	negligible	2561	0.3
Research (2)	6,769	5.9	1,343	0.2	8,112	0.9
Diploma Certificate	5,159	4.5	4,652	0.6	9,811	1.1
Total	1,14,410	100.0	7,65,746	100.0	8,80,156	100.0

Source: University Development in India. Basic Facts and Figures 1982-83 Part. I, Section A. Universities, Colleges, Enrolment and Teaching Staff.

**Table 2**  
**WOMEN ENROLMENT IN SCIENCE BY LEVEL**

	1979-80	1981-82	1982-83
Graduate	1,23,555	1,45,634	13,374
Post-graduate	13,655	16,745	9,165
Research	2,429	2,739	580
			(Research 1)
			(Research 2)
Diploma Certificates	459	548	251

Source: University Development in India, Basic Facts and Figures 1977-78 to 1981-82. Part I. Section A.

**Appendix III**  
**SEX DIFFERENCES IN PERFORMANCE IN SCIENCE**  
**[Ratio M/F Student Levels (Raw Score)]**

Country	<i>Age of Student</i>		<i>Secondary School</i>	<i>First Year University</i>
	<i>10 Years</i>	<i>14 Years</i>		
Australia	1.0	1.0	1.4	3.2
Belgium (Flanders)	1.0	1.5	1.5	4.2
Belgium (French)	1.1	1.3	1.2	
England	1.1	1.1	1.4	2.8
Federal Republic of Germany	1.1	1.1	1.6	3.5
France	–	–	1.0	–
Hungary	1.0	1.0	0.8	2.3
India	2.0	2.8	–	4.9
Japan	1.0	1.0	1.1	6.7
Netherlands	1.0	1.0	1.8	6.7
Sweden	1.0	1.0	1.1	2.0
Thailand	1.1	1.5	1.1	1.8
U.S.	1.0	1.0	1.1	3.8
All Countries	1.1	1.2	1.1	–

**Note:** For India, M/F standardised score was 1.0 whereas for England it was 26 and U.S.A. it was 20.

**Source:** Comber, L.C. and Keeves P. John (1973): "Science in 19 Countries" International Studies in Evaluation, Vol. I New York: Halstead Press, John Wiley and Sons.

**Appendix IV**  
**SCIENCE STANDARDISED SUBSET SCORES**

	<i>Biology</i>	<i>Earth Sciences</i>	<i>Physics</i>	<i>Number of Students</i>
<i>Developed Countries</i>				
Belgium (Flanders)	0.22	0.16	0.01	715
Belgium (France)	-0.32	-0.26	-0.26	764
England	-0.21	-0.05	-0.05	3,556
Federal Republic of Germany	-0.31	-0.16	-0.10	1,742
Finland	0.14	-0.04	0.09	1,290
Hungary	0.19	-0.06	-0.21	4,860
Italy	-0.14	0.09	-0.01	4,508
Japan	0.64	0.38	0.58	2,467
Netherlands	0.04	-0.29	-0.18	1,622
Scotland	-0.32	-0.23	-0.30	2,158
Sweden	0.17	0.20	0.16	1,982
U.S.A.	-0.10	0.07	0.33	5,432
Standard Deviation	2.96	3.03	3.43	
<i>Developing Countries</i>				
Chile	0.23	0.21	0.03	1,470
India	-0.01	0.03	0.12	2,662
Iran	-0.56	-0.42	-0.25	1,623
Thailand	0.33	0.17	0.10	1,822

Source: *Ibid.*

**REFERENCES**

- Comber, L.C. and Keeves, P. John (1973): "Science in 19 Countries", *International Studies in Evaluation*, Vol. I, New York: Halstead Press, John Wiley and Sons.
- CSIR (1982): *Technical Manpower Bulletin*, Vol. XXIV No. 10, (October), Government of India (1980): "Report of the Department of Science and Technology".
- Kamat, A.R. (1963): "Wastage in College Education", Bombay: Gokhale Institute of Politics and Economics; Asia Publication.
- Kaul, J.N (1974): "Higher Education in India, 1961-1971", Simla Institute of Advanced Study.
- Narayan, Shanker (1981): "Women in Science", Paper presented at the First National Conference on Women Studies S.N.D.T. University, Bombay: (April).
- Saxena, K.N. (1964): A Report on the Science Talent Search Examination. New Delhi: NCERT.
- Sen, N.B. (1969): "Development of Women's Education in New Delhi", New Delhi: New Book Co.
- Vanamala, M. (1983): "Employment Status of Women in Andhra Pradesh Public Enterprise", in Murali Manohar (Ed.) *Women's Status and Development in India*, Warangal: Society for Womens Status and Development.
- Vitter M. Betty (1983): "Tables in Science", Vol. 214, (18th December) condensed by National Academic of Science, Washington.



# 5

## Women and Career Motivation

Some of the earlier studies on women in different professions — discussed in Chapter III\* had emphasized “low professional commitment” (Ahmed 1974, Bhargava 1982) and explained these due to role perceptions of women. Their jobs were seen by the women as merely an addition to their basic domestic role. Shekaran (1981), and Daftary (1976), disagree with the claim that women have lower job involvement. They show that there are no differences between men and women in this respect. Mhatre (1977), argues that it is not so much a question of commitment because managers prefer women precisely for their dependability but she blames them for valuing job security and being dependent. They need militancy to push ahead. Wasi (1972), had shown that there has been a distinct change in the “educated working woman” — a new self-confidence and a positive self-image but she sounds a note of warning that in the increasingly competitive job market, women may no longer be able to retain a fine balance between home and profession.

There appears to be a confusion on the concept of career-involvement, career-commitment, etc. It is alternately used to mean either being serious about one's work and pursuing it against all odds, or it is used to mean having push, drive or aggressively seeking rewards.

It is acknowledged that most women possess job-involvement in terms of “sincerity” i.e., being devoted. The fact that women are sincere do not cheat, are responsible, conscientious etc., are repeatedly mentioned.

Commitment can only then mean that they are prepared to put in extra effort outside of their expected duties; or consciously seeking promotion and betterment. Most people use lower com-

mitment in the latter sense of lower *aspirations*. Women are seen as happy with what they have.

Again the "extra-effort" may be what is done outside office hours or taking on the load of extra responsibility that creates tensions which they may avoid as they already have two functions to balance. This may not be "defective" role perception but a realistic assessment of what they can reasonably cope with.

An alternate line of thinking in current literature is to question the very need for a career-drive. Instead of saying women do not overcome their subordinate status because they lack this drive, the question posed becomes, why should they have such a drive; is it at all good for either men or women? Achievement has been measured by success in three related areas: income, education and occupation. Distinctions have been made however between achievement behaviour and the motive to achieve. At the heart of this conceptualisation of achievement resides the desire on the part of social scientists to discover some pure state of the motive to achieve, *independent of society's value or reinforcements*. Whether achievement is referred to as a motive, drive or accomplishment and whether it is operationally defined as a "level of aspiration" or "standard of excellence" we are still referring to standards of success derived from a male conceived and male evaluated prestige system. In other words "achievement" to a woman is not equality in the workplace but the best combination or optimum combination of effort and satisfaction in the total life situation.

The danger in stopping the analysis at this point would be to end up condoning the status quo. Not that we are saying a mad and raving desire to achieve is an altogether good thing for any person. The problem acquires a dead solution because we are looking at career/status etc., as the result of purely *individual* actions.

Korda (1973) though fixing the analysis in individualist terms, points out that the discrepancy on what is seen as success between the sexes is itself born out of social valuation of men's and women's contributions. The criteria for male success in a competitive economy is "career-success". Domestic failures do not diminish that success. (A Nobel Prize winner could be a rotten husband or an irresponsible father and these blots will in no way detract from his fame). A successful woman remains by *definition* a success in the domestic area. If she fails in that area, no

amount of success in other areas can condone that failure in society's eyes. The modern office arrangement, professional work, the research establishments etc., have created a setting where these differentiations are hard to maintain. So long as the sexes were clearly segregated, these standards could be unequivocal. What does one do when one is faced with a competent, efficient, professional woman? Actual behaviour deviates from the norm still held by society so that a contradiction becomes inevitable. Women are said to suffer from distinction caused by "sex role stereotyping". The solution one repeatedly comes across is to diminish "sex role stereotyping", eradication of harmful sex stereotypes; instead of assigning traits arbitrarily according to preconceived roles, respect the claim of boys/girls/men/women in such a way that there is no loss of self-regard or blurring of identity. This can be accomplished by presentation of appropriate revised role models in the family, education system, etc. Garskoff (1971). The underlying assumption here is that sensitivity to sex stereotyping is a matter of consciousness raising—we each do *our* bit and behold, slowly the world will change. The incompleteness of this analysis lies in the total reliance on psychological variables alone with no reference to the material determinants of social arrangements.

There are some writers who see this material connection. Blueman (1976) and Rothman (1973) explore the implications of segregation by sex of the world of work, home, politics and recreation. Men can and commonly seek satisfaction for most of their needs from other men. They derive satisfaction for their intellectual, physical, political, economic, occupational, social power and status needs from other men. (This will be modified in societies like India where family status hinges on caste but to the extent that women do not directly control the crucial economic resources of the society, this above statement may be accepted). Women are forced to seek resources from men, and become resources (e.g., marriageable/giving male heir) in turn which men can use further. Marriage, children, women's work inside the outside the home become such resources. Men's positions in the resource-acquiring and resource-protecting roles mean that they have a dominance hierarchy in society which persists even after technology has obviated the need for such differentiation. While the homo-social (male network) is strong, female network in places of work is not so strong. Rival communities may have these strong ties; traditional societies also have preserved more of

these ties – the female kin support is still a very active element but in the situation of the middle-class in India that relies on services and professions, women still derive their status and resources through their relationships with fathers, husbands or sons. Thus, even when women succeed in occupying work roles which are high, their access to resources that offers the greatest potential advantage of power, viz. income is limited. Women preserve their status by marrying men with equal or higher occupational status than themselves. (In our sample this is true; other studies of professional women also indicate this). The division of labour within the home gives definite advantage to men. This additional work load on women presumably dampens their aspirations and limits the extra time, energy available which they can devote to improving their occupational positions.

In the labour market, employers, the judiciary, the political world, all act in an integrated and reinforcing way to maintain the dominant hierarchy, whereby men control the major resources, and maintain that control by segregation of the employment place as well as all domains of social life. Psychologically, "women become contoured by their conditioning to abandon autonomy and seek guidance". Sexuality is a power but the double standard for men and women denies women the channels or legitimacy of expressing this. "Female sexuality is a resource which is negotiable legitimately only within limited spheres. Thus, women cannot use this in other areas of social life – in interaction with the occupational world, the political arena or the educational system." (Blueman 1976).

Careers are advanced or destroyed through men's male networks; women's networks have very little influence. The conclusion of Blueman's analysis is that the absence of women from the occupational world is really a part of a much larger pattern of a male homo-social world. Women are excluded from this world because the lack of resources makes them less useful to men, and other women. Men recognising the power their male peers have, find one another more productive and important since they can contribute to virtually all aspects of each other's lives.

The burden of this argument is: male dominance exists because males control important resources in society. This is maintained through sexual segregation and by well developed peer networks. Women's subordination in the occupational structure arises out of both these exclusions.

Blueman's explanations of male life styles are perhaps true more of the West, but there is some transportability in so far as India has an even more highly segregated society.

"Women have a subordinate status in the occupational sphere but as most of them have married "higher" the compulsions to rebel against that lower status is not strong."

Men still in the majority in the workplace, are prepared to be "kind" to women, but are insensitive to the equality issue. The linkage to class status for women comes through the husbands/parents. Because women in the middle-class family occupy a position similar to that of their husbands in social status, the necessity to improve it *independently* of the family is not felt. Availability of extended family kin support and domestic servants minimise the difficulties of employment outside. At macro level changes can come only through changes in family systems and structural changes in the work (production) organisation. At micro level changes can be through negotiation between individual spouses, family members on sharing of family work. Women colleagues fighting for their rights would become potential threats to individual men, who do not all have employed "wives". The fundamental anomaly can be traced to the sexual division of labour in society wherein women are exclusively responsible for life maintenance, life creating activities.

Mill's (1976) work unravels systematically the way subordination affects the personalities of women. She admits that class and cultural differences are important but by concentrating on the forces which affect all women by virtue of their being women, one can understand why the position of women to men is one of permanent inequality. The dominant group has the greatest influence in determining a culture's overall outlook; its philosophy, morality, social theory, etc. Inequality creates a state of conflict and as the dominant group holds open power and authority, subordinates tend to develop models of interaction that are indirect. As open, self-initiated action invites drastic reprisals (through a combination of economic hardship, social ostracism, psychological isolation) they resort to actions designed to please the dominant group.

Women, Baker is saying, develop psychological attributes that make it difficult for them to openly rebel because their subordinate status moulds them so. The absence of "militancy" among women employees is usually seen to lie in women's

nature. Mill extends that observation to show that it is the conditioning that subordinate status induces.

The extent of subordination or autonomy has been subject to much debate among women studies scholars. Granting that in societies where there are clearly segregated spheres of activity and within these spheres, women might enjoy a great deal of autonomy, we still have to take note of the fact that the control of crucial resources is in the hands of men in most societies. We may accept that subordination exists though varying in degrees. More importantly for our immediate concern, the public sphere has been invariably less influenced by women.

These authors have gone beyond the language of roles. Strober (1976) thinks that differentiations by sex or occupations change only when there is a jolt from outside, that simultaneously alters social values and the demand for female labour. This can explain how women have entered science; it cannot explain why they are subordinate therein.

Cross cultural studies are useful to minimise ethnocentric portrayals. Naidoo (1980) describes the differences between South Asians and Canadians in the Canadian setting and while an expatriate group is not necessarily representative of the original native groups in their own indigenous setting, some observations she makes are useful for us here. Both girls and boys were expected equally to be loyal to the family, obedient to elders and concerned with others. The American stark dichotomy of girls being "nurturing" and boys being competitive and outside-world looking does not operate to the same degree. (Jaiswal's (1981) study of women and men engineers as well as Rahman and others on Indian scientists took note of the family centredness of men in India). The difference was that girls had to face greater restrictions in movement outside their homes, but they felt compensated by the feeling of being special, loved by people and getting attention. They had negligible anxiety regarding success, no feeling of loss of femininity, no fear of social rejection. They had a high achievement motive to get good grades, perform well academically. The North American by contrast exhibited a greater anxiety component perhaps because of the historical cultural dichotomisation of the nature of maleness and femaleness that has existed in Western culture until recently whereas in Asian societies there is much greater complementarity, which leaves them free to model themselves in new endeavours which in

Western societies would be categorised as male or female, (e.g., men are typists in these Asian countries and Asian women can be doctors). Anxiety regarding gender identity does not prevail (Nandy 1976). According to Naldoo, South Asian women may tend to both experience and retain traditionally feminine behaviours, this traditionalism does not extend to achievement motive, i.e., traditional socialisation and achievement may be independent dimensions in Hindu culture rather than correlated dimensions as in the Western culture. South Asian women in the Naldoo study emerge as clearly "traditional" on values pertaining to home, family, children and religion but they do not experience fear of success, they show high achievement motivation, high aspirations for themselves and their daughters.

Naldoo's study has several snags. It may be true that good academic performance is not regarded as anti-feminine or being able to "accomplish" something. Indian culture has valued such accomplishments, in the arts for example, but what happens to women when achievement, not in terms of personal growth, but competitive rewards are considered? The author totally ignores this dimension. There are other invisible elements that give higher sense of security to Asian women. Their marriages are arranged and do not depend upon individual attractiveness to male in a free choice system. Their men do not "mind" their wives being "accomplished" so long as other obligations and loyalties are maintained. Naldoo's interpretation of achievements is defined in a very narrow sense. She ignores the possibility of future conflict when the highly achieving women enter a job market; she discounts the special status of the expatriate who are a selective group, achievement oriented enough to migrate and settle in foreign countries. Would an average Indian husband tolerate a highly achieving wife in an Indian setting? Her reference group is the upper class who back home always had domestic servants to do heavy chores and whose women could cultivate the arts and add extra lustre to their families, whose indulgence in such accomplishments did not seriously disrupt the fundamental requirements of family life which would be not true in the more democratic economy and society. Naldoo's formulation is a total cultural category, without any linkage to the economic structure of the two countries or regions. The emphasis that research on Asian societies gives to sex role differentiation by an indiscriminate and uncritical use of American concepts and methodology does not represent real situations in societies where class

and economic differences are far more significant. Women may enjoy egalitarian relationships in certain contexts of family or kin and yet be objects of exploitation and the major task is to identify and analyse these forms of exploitation. As we have mentioned earlier, the pursuit of the "achievement" motive or individual aspiration as a yardstick befuddles the issue and conceals the STRUCTURAL inequality in the system. It divides the women by depoliticising the issue, by making it appear that success is a matter of individual ability. Laws (1976) has voiced many of these inadequacies in her excellent treatment of the subject. She shows how complex the entity "aspiration" is.

Aspiration is a psychological term used in a specific way to denote a dynamic process involving goal setting, effortful striving and events that provide feedback to success or failure. It has been shown to vary positively with performance. Aspiration and motivation are interrelated, because motivation is a part of aspiration. Motivation is itself a function of expectancy and value (one will seek those things that have social value). Expectancy is the subjective judgement of probability that an event will occur or may be based on definite information. Value wise, it may be a positive or negative incentive. Behaviourally, it is a tendency to avoid or approach a given state of affairs. Thus, the context of information and incentive should always be remembered. Aspiration does not exist outside a given context.

There are several myths that abound in the sociology of occupation (such as the male as the "sole breadwinner", home-making is a "career" etc.) but a glaring fallacy revolves round the myth of the male professional. Firstly, men are assumed to have only one role so that the empirical fact of women managing home and career becomes something to be explained. Secondly, there is the image of the heroic male professional marked by his zeal for work (Do we see here the ghost of the Economic Man?), an internalised, God like devotion independent of pay or work week! His work is supposed to be the most important thing in his life. I cannot resist quoting the picturesque words of Laws, "Self motivated, he (the professional) assumes complete responsibility for his work and routinely turns in a superior performance. He has high standards and ethics; he does not given in to *selfish* (italics mine) concerns like personal and family life." Against this lofty ideal of the dedicated scientist, the female worker falls short by invidious comparison. What is central here is the implied valua-



tion regarding the relative worth and value of career and family life.

The majority of men hardly conform to this idealised picture of the deeply committed male professional! An IIT study found no evidence that work was the central life interest for men (Nandi 1982).

Per contra, the women worker is supposed to suffer from a deficit of this quality called "commitment" and aspiration in career. If there was a valid psychological entity operating which is independent of material conditions we would expect it to manifest itself as perseverance in the face of obstacles. In which case, should we attribute commitment to those who have all the favourable circumstances for occupational success? Rather, motivation should be ascribed to those who overcome many obstacles to attain the desired state.

The whole achievement-motive career aspiration etc., is a sterile debate. They are fallacious because they locate the causes of the differential outcomes between men and women in the parameters of behaviour that lie within the individual's control thereby diverting attention away from gross differences in the external instrumentalities that influence these outcomes. They are invalid also because they make uncritical comparisons between *all* employed women and a few privileged minority of working men who may be able to approximate the ideal of the "dedicated" professional who ignores all other material constraints.

Similarly, the repeated reference to choice by women of certain lines of occupation make a similar, untenable presumption that occupational choice is purely voluntary without including the real matrix of employment options.

Laws is critical of the kind of studies that seek to find out why or how some women are successful. (We can recall here the "Determinants of Success" study quoted earlier). The approach is that these women or their achievement is a phenomenon which is exceptional and deviant. The deviance holds the interest, not the original subject of study namely the quality of "achievement" is what provokes explanations but in such studies there are no comparable groups or control groups.

Indian studies have been concerned with job satisfaction and it is correlated with job performance, productivity and

profits. It is generally agreed that the incentives, other things being equal are: high pay, autonomy, prestige, opportunity for advancement, opportunity for skill utilisation, skill itself, high interest in the task itself and high job satisfaction and increase in productivity. Existing differences between men and women even within an occupation, load the disincentives all to one side. We forget this structural inequality because we tend to take the unit of analysis as the individual worker and we ignore the predictors at the group level. If women's only source of information about inequitable status is direct observation, it tends to mute their discontent and the likelihood of activism. If information enters through research, which indicates their group status there is likely to emerge greater discontent. In the future, more women are going to be interested in job outcomes as job begins to be more central to their lives. We see that in our study there were 59 women *deeply concerned* about inequality. We also had a good proportion of single women – unmarried, divorced, widowed who were SOLE earners. As more women enter, as material conditions change making it necessary for many women to seek better job outcomes or in addition the rising consciousness of women drives them to seek total economic independence, the trends *will* change.

The moment a woman begins the struggle, she is confronted with issues of equality, respect, autonomy. She experiences discrimination, denial, deprivation, rejection. Frightened by the outcome of confrontation, many women deny themselves their legitimate space or ignore their own vast potential. When they demand from society and from their male counterparts equality and acknowledgement of their competence, they at best receive some patronage and meager resources. Given inadequate infrastructural support and non-inclusion in decision policy making, they in effect become marginal to the system.

“Professional women who have attempted to work with their potential, capabilities and resources and have entered the world of occupations and careers, are caught in a bind between their traditional past and the changes of modern times. Accepting both, they suffer from overburden. These women continually struggle within the system to find freedom. Many women in this struggle fear social stigma, isolation and loneliness” (Parekh 1982).

Concepts like achievement, aspiration etc., are uncritically employed. They are a relatively enduring propensity to strive for success in *any* situation, where standards of excellence are applicable. After all, the behavioural tendencies or outcomes are the same whether we employ them for success within a career or for *any goal*. Women's achievement goals could be different from men's. Behaviourally they show all the tendencies that characterise any achievement motive: effortful striving, persistence, overcoming obstacles, etc. If we perceive this difference then the same cues should not be employed. Women may be making tremendous sacrifices just to *get entry* and keep their place and this may be the measure of their commitment and achievement.

#### REFERENCES

- Blueman Lipman Jean (1976): "The Social Institution of Occupational Segregation", *Signs*, Vol. 1, No. 3, Part 2, (Spring).
- Garskoff H. Michele (Ed.) (1971): "The Roles that Women Play: Leading Towards Women's Liberation", California (U.S.A.): Cole Bennet.
- Jaiswal, R.P. (1981): "Status of Working Men and Women Engineers", An Analysis based on fifty engineers in Kerala. Unpublished paper presented at the First National Conference on Women Studies S.N.D.T. Women's University: Bombay, (April).
- Korda, Michael (1973): "Male Chauvinism and How it Works", New York: Random House.
- Laws, Long Judith (1976): "Work Aspiration of Women", in *Women and the Work Place*, (Ed.) Martha Blaxall and Barbara Reagan, U.S.A.: Chicago University Press.
- Mill, Baker Jean (1976): "Towards a New Psychology of Women", England: Penguin.
- Naldoo Josephine (1980): "Women of South Asian and Anglo-Saxon Origins in the Canadian Context: Self Perceptions, Socialisation, Achievement Aspirations:", in Conni Stark Adamce (Ed.) *Sex Roles, Origins, Influences and Implications for Women*, Montreal, Canada: Eden Press.
- Nandy, D. Ashis (1976): "Woman and Womanliness in Indian Culture", in B.R. Nanda (Ed.) *Indian Women, from Purdah to Modernity*, New Delhi: Vikas.
- Nandi, Proshantak (1982): "Professionals' Central Life Interest in a Non-Western Society", *Sociological Abstracts* Vol. 30, (August Supplement 116).
- Parekh, Indira (1982): *Express Magazine*, (3rd January).
- Rothman, Shiela (1973): "Woman's Proper Place—A History of Changing Ideals and Practices, 1870 to the Present", New York: Basic Books.
- Strober H. Myra (1976): "Study of Dimorphics", in *Women and the Work Place—the Implications of Occupational Segregation*, (Eds.) Martha Blaxal, Barbara Reagan, U.S.A.: University of Chicago Press.



**PART TWO**  
**EMPIRICAL EVIDENCE**



# 1

## Introduction

### **Scientific and Technological Careers for Women**

The backwardness of a country is today largely judged by the level of technology attained by it and the extent of employment in non-agricultural sector. Even where there is some degree of new technology, its spread is restricted by class and gender.

In a patriarchal system, subject to the onslaught of rapid industrialisation, the separation of the work sphere from the home leads to men moving out of the confines of the family home and acquiring specialised skills in order to qualify for entry into the labour market. Women, however, continue to be relegated to the traditional and the informal sector. This differentiation begins early but gets more pronounced after primary education. Boys get specifically trained for the labour market while girls continue to receive education with little vocational content to it. The situation is changing but all too slowly if we go by the impact on gender socialisation and levels of equality in terms of access as well as outcome.

The first step towards equality is equal access. The mere provision of schools does not ensure equal access. There are a host of interdependent factors that derive from a complex set of prejudices, traditional beliefs and cultural norms. The social process of selection and exclusion for systematic technical training is a self perpetuating cycle defined as it is by the notion of women's proper role.

In developing countries there is, to start with, a shortage of educational facilities. This is compounded with the preference that families give to boys' education. Employment in the non-agricultural sector depends on the growth of the economy and there is considerable mismatch between the output from educational institutions and the jobs generated by the economy. These scarce jobs usually become available to or are taken advantage of

by men. Employment opportunities are tied to planned training in anticipation of or in response to trends in labour absorption. Training programmes for women all over the non-socialist world are handicapped by lack of planned outlets for student's skills. Their training is not planned to synchronise with the available occupational options and therefore generally results in their being slotted into low skill, dead end jobs. Educational patterns of girls and boys are relevant to understand the direction of social change. These patterns are not innocuous in their implications for they reflect ideological underpinnings. Who has access to what kind of knowledge springs from the unequal power relations between different classes and unequal power between males and females in society. The content of education is ultimately an instrument of control, a power play in the interests of gender, class and social hegemony. (O'Brien et al 1983). If nurses are mainly women and doctors are mainly men, nursing as a profession is rated lower than that of doctors. What are the factors that influence the choice of courses for women? If this choice imprisons women within a limited space, the status quo of women's low employment will persist.

The choice of courses or jobs for women is not merely a matter of what is considered suitable for women as defined by so called feminine qualities or women's role in society but they are equally influenced by considerations about the work — environment. A factory job with many men workers would be seen as unsafe for a young woman. An office job or jobs with a heavy concentration of women would be perceived as more suitable. Until enough women get into an all male profession or occupation, it is not "safe" for women or is thought undesirable, but enough women cannot get in without a change in the social attitudes. Two decades ago, office jobs (secretarial) were less welcome than teaching but today the clerical-secretarial is becoming female dominated even in India. (They became so, much earlier in the West.) The undesirability of an occupation is judged by the degree of vulnerability for women for sexual exploitation or social stigma. Barriers are loosening but quantitatively, there are all too few women in the non-traditional, higher skilled jobs. The option for certain type of courses for women is in addition exercised as a contingent plan. A girl should be doing something *till* she gets married, after which it might not be necessary for her to pursue a career unless there is an economic compulsion. It is ironical how norms get relaxed when a woman's



earnings are needed by the family. A boy on the other hand is expected to plan for a lifetime career. For a woman, not to be employed and be supported by a man is in itself a mark of class status.

The level of technical education obtained is also a class factor, male or female. Post secondary technical education is for the working class, university level education is the middle class preserve. The class destination gets sharpened in the case of girls. The best students go to universities and post school technical education in the West has taken on the stigma earlier attached to manual labour. Class defines not only the type of job but the *location* of the job. Serving as a waiter in an ordinary eatery is low status, but being a steward or stewardess in an airline or a waiter/waitress in a five star hotel becomes high status merely because the clientele is different.

In India, institutions that offer technical education at post school level form barely 0.37% of all institutions; student enrolment is a mere 2.0% of total number of students in all institutions. The expenditure on vocational and technical education is less than 1.5% of total expenditure on education. Educational expansion in India has been more of a response to political pressures and has not been induced by a demand from the economy for trained hands.

Within this limited availability of technical education women's share is still smaller. If science and technology are to really benefit women, conscious efforts will have to be made to bring women into science and technology institutions. Conditions will have to be created that will make the utilisation of available resources by girls and women, possible. This may require several kinds of official support for girls' vocational and technical education.

Getting them into technical scientific institutions is only the first step. Diversifying within the technical stream is a second step. The third would be provision of support services such that they can use their skills and abilities. Finally, women need to be involved in the planning and decision-making at all levels, as equal partners in society. Formal equality of access has not removed gender bias in any society [Krishnaraj 1984]. Women need to contribute not just by using available technology but need to be involved also in the generation of technology.

This present section examines situations through empirical studies where women *have* had access. How have they benefitted? What are the constraints that remain? The first essay describes the career status of women scientists and also raises questions such as whether exposure to science has implications for their attitudes and behaviour. Is science a liberating agent? To the extent that the science they learn is structured within a particular society, the possibilities for the liberation potential is limited. Within the employment aspect, while these women have not done badly, they are much below what they could have achieved.

The second essay looks at women who are highly qualified in science but are unemployed and demonstrates that the labour market definition of voluntary unemployment for those not seeking work is inappropriate for women in as much as it is involuntary due to social pressure. They do not seek work because they are obliged not to.

The third essay describes an attempt by the government to provide a special scheme for vocational training for women by setting up three regional institutions exclusively for women. This study demonstrates the need for careful choice of courses for employment and auxiliary support such as credit, marketing, etc., if women have to be self-supporting.

The fourth is a small pilot study of women in computer industry – a frontier technology. Once again, it appears, just getting there is not enough. Hurdles remain by way of discrimination at work and obstacles due to women's dual roles.

These four studies were a beginning exploration done between 1977 and 1984 into an area, hardly examined till now and were therefore the pioneering efforts by the Research Centre for Women's Studies, SNDT Women's University. I believe things are changing for the better for women, in science and technology careers. Many all women polytechnics have sprung up. Women are entering many new areas. The social environment for middle-class women has improved in many ways though many fetters remain, especially in the area of rights within marriage and family.

**REFERENCES**

- Krishnaraj Maithreyi (1984): "Interdependence Between Science and Technology and Socio-Cultural Environment. The Relations of Gender" in A. Ahmed and M.A. Quereshi (ed.) *Social Relations of Scientific and Technological Change*, New Delhi: NISTAD.
- O'Brien, Mary *et. al.* (1983): "Feminism and Education: A Critical Review Essay" in *Resources for Feminist Research* Vol. XII, No. 3, Nov.

# 2

## Women Scientists in Bombay: Half Way Up

### Scope and Methodology

The study\* related broadly to women with science degrees working in science establishments. The conventional notion of a scientist is that of a person involved in fundamental research and who makes significant contribution to knowledge in his area of specialisation. This excludes people not doing fundamental research and is much too narrow in scope. This view of a scientist might have suited the eighteenth century when the scientist invariably was a lone explorer. In the present century there are vast numbers of science trained persons working as employees in organisations run by the government or industry, engaged in team work rather than individual work, self-regulated and self-selected. If we include science qualified persons who may be working in all establishments including non-scientific establishments the universe becomes too vast to be meaningful. Firstly, we need scientists still in touch with science. Secondly, what subjects do we include under science? The list of subjects included under science is increasing day-by-day. We decided to stick to the subjects usually included under science faculty in university courses and have excluded professional courses such as medicine, applied sciences and technology. The definition of a scientist chosen here is, "A person who has a degree in pure science and who is working in science establishment". By restricting ourselves to scientific establishment we can presume they have a link with science.

### Profession

The word profession is used in its broad sense of a learned profession or occupation that requires specialised knowledge and carries prestige. It is not used in the sense of a scientific profession as an autonomous community as has Merton (1973).

Until recently, profession in sociology was used to refer to those honoured servants of public need, conceiving of them as occupations especially distinguished from others by their orientation to serving the needs of the public through the schooled application of their unusually esoteric knowledge and complex skills (Dingwal & Lewis, 1983).

There is the concept of profession that refers to a broad stratum of relatively prestigious but varied occupations whose members have all had the same kind of higher education and who are identified more by educational status than by special skills.

A third definition applied where certain occupations have particular institutional or ideological traits more or less common to all members, which gives them a distinctive occupational identity and exclusionary market shelters.

The "essence" of a profession need not be an issue if we accept that one's conceptualisation is useful for its capacity to order or guide explanations of the circumstances of a variety of historical occupations no matter how they are labelled by one audience or another in a particular country or time. It was only in late nineteenth century that science, even in Europe, became institutionalised and in a more differentiated and stable form. In many Third World countries, the relative role of occupational identity and elite-identity are not easily distinguished because of the restricted scope of higher education. Therefore, a "broad" view of profession is more appropriate.

### **Career**

Career is usually with reference to occupational experience of workers in jobs that have achievement in a hierarchic ladder (Stebbins 1970). However, the sequence of steps or stages in social institutions may not be always clear cut and may be created through negotiation or struggle. The subjective aspect relates to a person's recognition and interpretation of past and future events associated with a particular status. This makes it difficult to compare careers of disparate groups like teachers, researchers, laboratory assistants and clerks. To a research scientist, career status may be measured by publication, recognition through awards or appointment to prestige posts. What is a career for a clerk?

These are insurmountable problems in measuring subjective responses such as "commitment". Does commitment mean

staying on or pushing ahead? There are many jobs that have no avenues for promotion.

The term "career" is used here in a loose, broad sense of a long term commitment to a definite occupation and we use both objective and subjective indicators, with the weights more in favour of objective indices.

Who are the women scientists and what are their characteristics? We give certain descriptive features of the group such as their personal and social background, their career status, their family environment, their own perceptions of their career status and their attitudes to science and their perceptions of its significance.

The dominant theme in the study related to the question: Have women gained by science? This has two aspects. One pertains to the use of science through employment in a scientific institution. The second deals with the use of science in their home life. At the place of work, what rewards have they obtained, both material and non-material? In their own life, to what extent have they gained by exposure to science? Has it led them to evaluate the usefulness of science and the scientific basis of many traditional practices they follow at home?

The first set of questions were examined through a very detailed probe into the career outcome of the women. In evaluating their overall status in their career, the influence of different sets of factors are analysed. These cover the following: (1) age and marital status, (2) level and quality of educational qualification, (3) organisational features of the place of work such as the type of work that the establishment carries out, its ownership and size, (4) (a) family background in terms of educational level, science background of parents, parents-in-law, spouses and the occupation of spouses, (b) the degree to which the family provides a supportive environment, and (5) the relative commitment of the group to a science career.

As for the question of how they have benefitted from science, this is judged through their own evaluation of the importance of science and their application of scientific knowledge and outlook on some of the traditional practices. Do they examine tradition in the light of their own scientific knowledge and does this express itself in behavioural outcome?

The above set of variables—age, marital status, type of work, family background, influence the outcome; in other words are the noticeable differences associated with these variables?

To summarise, the issues posed by the study were the following:

1. Is the career status of women scientists the result of:  
(a) their lack of "commitment" (however defined); or  
(b) due to special obstacles at the place of work, or both?

Which of these would have a greater weight in this case? Can "career-commitment" be really regarded as an exogenous variable or is it itself determined by factors operative at different levels? How influential is the family in this process?

2. Is the degree of scientific outlook imbibed by women scientists the result of: (a) special circumstances in their personal life; (b) the nature of the scientific enterprise in India?

The broad objectives of the survey were:

- (i) To analyse the social background of these employed women scientists;
- (ii) To discover their job status;
- (iii) To locate discrimination if any;
- (iv) To see differences as between organisations;
- (v) To see family support and constraints;
- (vi) To get an idea of the women scientists' approach to a career and approach to science.

Areas which the inquiry covered:

### **Personal Profile of Respondents**

Age, marital status, religion, economic status, household ownership, level of education, training, experiences, breaks in education or career, and the reasons for them.

### **Family Set-up**

Number of family members, educational status of parents and in the case of married women, the educational level of in-laws and spouses, science background of family members; difficulties posed by marriage, children; degree of household responsibility and extent of cooperation from other family members; control over income; sources of motivation; nature of obstacles.

**Career (or Job) Status**

The respondents' place in the job hierarchy in terms of salary level and designation; job security; promotion prospects; facilities available; working conditions including commuting time; extent of use of previous training; opportunity for inservice training, promotions, leadership, initiative and discrimination not only felt, but instances of it.

**Approach to Career**

The respondents' response to their work situation, their expectations, their preparation etc. their involvement in professional and union activities.

Here we seek to verify some commonly held impressions. Do women seek congenial work situation rather than high achievement, competitive jobs? Do they stay in lower paid, lower prestige jobs by turning down chances of advancement for fear of extra responsibility they cannot cope with? What really are the obstacles that lie not in women's attitude but within the organisation? Do women have special difficulties not applicable to men? Do women not choose their careers carefully but merely blunder into them? Does lower job status relative to their qualifications imply lower mobility or less initiative?

What kind of scope exists in the organisation for exercising initiative, for redressal of grievances? How do male superiors, colleagues view women?

**Approach to Science**

How do women think science helps them and helps society? As science qualified women, what are their behavioural outcomes in day-to-day life, especially in areas of life where women, in their domestic role are particularly involved in India – such as fasts, keeping vows, observance of various taboos etc. What are the practices observed for food preparation, health care, child care and socialisation. In particular what efforts are taken to promote science mindedness among children?

What is their own rating of a scientist as a profession as compared to other prestigious professions? How do they see the value of science to society? What kind of benefit have they gained by learning science and being occupied in a scientific environment?



### **Sample Frame and Sampling**

Our sample frame consists of organisations broadly categorised as "science oriented" organisations that employ science qualified persons in Bombay. Our list was based on the Directory of Scientific Institutions published by the Indian National Science Documentation Centre (INSDOC). As the list was dated, we supplemented this by reference to local directories and discussions with experts. The INSDOC definition of a science establishment as one carrying out any one or more of activities like teaching, research testing and standardisation was employed for getting our sample frame. We compiled a list of teaching establishments from the annual returns of the University of Bombay; of pharmaceutical companies from the membership list of the Organisation of the Pharmaceutical Producers of India (OPPI). A list of hospitals and testing laboratories was obtained from the state government and municipal offices.

### **Preparation of the Sample Frame**

The following types of establishments were covered: (a) teaching; (b) research; (c) institutions that have R & D sections; (d) hospital pathology departments and research sections; (e) government departments including central, state, local bodies located in Bombay, having testing and standardisation units.

Letters were mailed to over 300 organisations located in Bombay to obtain names, designations, qualification and years of experience of women with B.Sc. and above, employed in any of the above sectors. Establishments that did not have women science degree holders, those that had women with applied science degrees and women who had less than one year's experience were rejected. The final frame included 110 establishments with 1284 women with B.Sc. and above qualification.

### **Sample Design**

To get adequate representation of all types of establishments, a multistage stratification was adopted. The primary matrix was the major function of the organisation as this would largely determine the nature of the work done. Functional categories used, according to the primary orientation of the establishment were: (1) teaching; (2) research; (3) production; (4) service. In production oriented establishments only those establishments were included that employ science degree holders. These were identified to be mainly pharmaceutical companies, fertilizer factories and consultancy firms. In research organisa-

tions, not only those institutions specifically devoted to scientific research were included but also R & D departments of industrial units. Teaching units included all colleges and university departments that have science faculties. "Service" establishments covered those testing units that are attached to government departments and hospitals. These comprised forensic laboratories, food and drug testing departments, testing units attached to water and sanitation wings and environmental testing institutes, all of which were either governmental or government aided departments. In addition pathological laboratories attached to private, government hospitals were also in this category.

Some degree of overlapping was unavoidable as many establishments combine different functions, but in so far as usually one function tends to be dominant, it is not inaccurate to classify them this way.

A second stratification was that of ownership and control. The classifications used were public sector, private sector and joint sector. The terms and conditions of work, and the work culture in these sectors vary, and women's career status may be influenced by the sector in which they work.

The third stratification was based on the size of the establishment. Size influences management practices and worker conditions. It would have been ideal to also take into account the proportions of women employed in each establishment to see whether concentration of women makes a difference but this data was not available. Size was defined by the total employment of the organisation. Where establishments had several branches in other cities we restricted it to the Bombay branch. We took four size categories: 1-100; 101-1000; 1001-5000 and over 5,000 total employee strength including all categories of workers.

For listing of women employees with B.Sc. and above we approached each establishment individually as well as through records (if these were available, as in the case of colleges.)

Our sample frame after eliminations for categories that did not fit our definitions was as follows:

**Table 2.1**  
**SAMPLE FRAME**

<i>Type of Establish- ment (Function)</i>	<i>Sector</i>					
	<i>Public</i>		<i>Private</i>		<i>Joint</i>	
	<i>No. of Units</i>	<i>No. of Women</i>	<i>No. of Units</i>	<i>No. of Women</i>	<i>No. of Units</i>	<i>No. of Women</i>
Teaching	8	80	22	273	—	—
Research	12	442	—	—	3	17
Produc- tion	—	—	32	317	—	—
Service	20	203	11	52	—	—

### **Sample Selection**

The sample size on the basis of two categories — career progress and absence of career progress at 10% error and level of confidence of 95% was 400.

To select a sample of 400 women distributed in 8 cells, we took one third from each cell by a two stage sampling: (1) selection of units in each strata; (2) selection of women from each unit. Selection was through random sampling using a table of random numbers. While the proportion was 1/3 with a minimum of one for each organisation, all the cases in a selected unit were taken if the numbers were less then the required number.

The final sample of 400 was as follows:

<i>No. of Institutions</i>	<i>Type</i>	<i>No. of Women</i>
12	Teaching	120
7	Research	124
12	Service	91
12	Industry	65

### **Tools of Data Collection**

A self administered questionnaire was used. This was supplemented by 30 indepth interviews or case histories.

The questionnaire was discussed with experts from CSIR, AMIR, UGC, TIFR and BARC. The questionnaire was based on some of the issues that came up and gaps in information noticed by an earlier survey conducted by the Indian Women Scientists' Association (IWSA) based on the responses of the members of the

association and with which the author was intimately associated in the analysis of the results. This study was not based on proper sampling and was based on a short proforma seeking information on their career and as such was a limited inquiry. Two questions that the results could not answer were, one regarding the continuity or discontinuity of women's education and career and second on what form discrimination takes. The survey elaborated on these areas and also attempted to map a much more detailed profile of the careers of the women scientists. The addition of their attitude to science and career further expanded the area of investigation.

A pilot study with 21 sample establishments and 41 women drawn from a random sample from these establishments was done to test the questionnaire and the final questionnaire was refined and improved accordingly.

### **Case Histories**

Based on the findings of the sample survey of 400 women scientists, thirty cases were selected for detailed indepth interviews. There were two groups selected: (a) those who may be termed high-achievers, and (b) those who may be termed low-achievers. Achievement here referred to post held in the establishment. High achievers were those women who had the highest posts among the sample. They were not high achievers vis-a-vis the men nor were they always the highest in their establishment.

These two groups were carefully selected to represent: (1) the different type of establishments: public or private sector; and (2) different categories of work done — teaching, research, technical work or administrative work; (3) family environment.

All these indepth interviews were conducted at the homes of the respondents and lasted several hours and many sittings. Detailed guidelines were prepared for these indepth interviews.

The objectives as mentioned before were to understand:

- (1) The circumstances at home (or elsewhere) that shaped the respondents' education and career particularly family atmosphere in general — 'whether progressive, tolerant, indifferent etc.;
- (2) Any experience of discrimination at the work place and the precise form it took;
- (3) The respondent's views on science and the application of science to one's own life.

**Table 2.2**  
**SELECTION OF CASES FOR INDEPTH STUDY**

Type	Favour- able work environ- ment	Not so favourable work en- viron- ment	Favourable family en- viron- ment	Not so favourable family en- viron- ment	Total
<i>Teaching</i>					
High achiever	—	2	—	2	4
Low achiever	—		2	2	4
<i>Research</i>					
High achiever	2	1	—	—	3
Low achiever	—	1	—	—	1
<i>Technical</i>					
High achiever	—		2	3	5
Low achiever	3	3	—	—	6
<i>Administrative</i>					
High achiever	2	1	—	—	3
Low achiever	—	4	—	—	4
	7	12	4	7	30

The case history material was used to supplement the survey findings. Respondent's own ambition was interpreted as any strong desire to do something and steps taken to realise the goal. What did the respondent see as her own strength or achievement? Did she feel girls suffer special handicaps in science as opposed to arts and how did the respondent feel about having taken up science? If holding a relatively high post, what did she owe her success to? If in a low post, what circumstances hindered her doing better?

With respect to discrimination experienced by the respondent, the following items of information were covered:

- (1) The number of women in the respondent's section;
- (2) Any instance of a male being preferred even when an equally qualified female was available for promotion, serving on committees, taking up prestigious projects, attending seminars, conferences, sponsorship for grants, facilities and freedom for publications;
- (3) Attitude of male supervisors, male juniors;

(4) General feeling among the staff regarding women scientists.

On attitude of the respondent to science and its everyday use the questions covered were the following:

How would the respondent define a scientific outlook? Does science education help one get it? How important is it to have it? Would she say, she has a scientific outlook? How does she see the connection between religion and science? Does she believe in horoscopes, fads, godmen? Has she examined her own life, practices to assess their rationality? What are the principles of a scientific method?

The responses of these indepth interviews were used to supplement the findings of the survey, to interpret them better and to draw broad conclusions.

## I

### **SOCIAL AND DEMOGRAPHIC BACKGROUND OF THE WOMEN SCIENTISTS IN THE SAMPLE**

The present section examines the social and demographic characteristics of the sample. The features examined are age, marital status, religion, size of household, educational level of parents, parents-in-law and spouses, occupation of spouses, number and age of children. These give a general picture of the group's social status.

The entry of women in science seems to have taken place in the sixties from the age profile we get.

The major part of the group (i.e., about 85.75%) was below 45 years; of these nearly 77.5% were below 35 years. Almost half the total group of women were below 30 years. This age profile agrees closely with findings of other studies (Jaiswal 1981; Chakravarty 1984; Census 1961, 1971).

#### **Marital Status**

Of the sample, 239 (59.75%) were married, another 8 were widowed (2.00%), three were divorced (0.75%). The unmarried comprised 150 in number and were (37.5%) of the sample. The preponderance of the married women is not surprising, demographically, considering the near universality of marriage among Indian women and their average age of marriage in urban India (18-20). However, the presence of a large number of married

women in science establishments indicates that marriage has not stopped them from working. Whether they have been working continuously or not or had rejoined after breaks is dealt with later but that many are in the younger age group even among the married, allows us to presume that they keep their jobs.

There were 23 single unmarried women over 40. This too is a newly emerging phenomenon. The extent of this is not known, but Census figures suggest that the number and proportion of unmarried single women has grown over the years.

### **Religion**

The Hindus and other subsidiary groups were an overwhelming number. 323 women (80.75%) were Hindus of whom 17 women (4.25%) were Jains and 1 woman was a Sikh). There were 9 Muslims (2.25%) but a bigger Christian and Parsi group – 32 (8.0%) and 14 (3.5%) respectively. There were only 2 Jewish women.

The proportion of ever married among the Muslims (44.5%), Jains (41.2%), and Parsi (57.0%) was lower than among Hindus (60.9%).

### **Size of Household**

Very detailed data on the social background of the group was not obtained for two reasons: (a) the class background of educated, urban women is well known through numerous studies; (b) the important variables relevant to our study were much more, such as the educational background and size of the household. Nearly 70% of the women live in households with more than four members and excluding 3% who live in hostels or paying guest accommodations, the remaining live in their own flats or official quarters. Only 24 women (6%) have office quarters allotted to themselves.

As we were investigating the encouragement received at home for science education and science career it was felt that the level of educational attainment of parents and in-laws would be an important influence.

Only 2.23% women come from very poorly educated families, where atleast one parent had less than high school education; among those with parental qualification of high school and above, nearly a third had college education. In most cases, mother's education was lower than that of the father. This educational background of the families of the women confirms the

hypothesis that in India for women, higher education is the *result* of higher family status (Papanek 1983). Encouragement to women's higher education comes from families with higher economic and class status. In contrast the men scientists in the study by Rahman (1973) and others found that the majority of them came from lower middle-class with lower level of parental education than in the present sample.

In the family educational background, religion wise the Muslims had the lowest level, with 33% having only elementary education or below, 55% high school and not a single parent with college education. The most highly educated were the Parsis, with 78% having high school and 22% college education; followed by Christians who had 60% high school and 37.5% college level. The Jains had the highest proportion of parents with high school education, only one parent without formal education and none with college background. The social status and the relative value attached to higher education was reflected in the sample.

Did our women come from families with science background? It appears to be so, for as many as 79% have such a background (of these 79% there are 40 women (10%)) whose family members have specialized exclusively in science. Once again the contrast with the men's group is striking. In the survey of scientists by Rahman and others it was found that the majority of them came from families with no science background. In a sense, our women are second (some may be third) generation science learners.

While the educational level of the parents tell us a good deal about the nature of the group, the level of education of parents-in-law was important for the influence it might have on the kind of environment provided to our women for the pursuit of their careers and the possibility of frictions and difficulties in adjustment.

These women have married into families with a lower educational background. As many as 71% married women have in-laws with elementary education or below, with mothers-in-law having lower educational level than fathers-in-law.

Another index of their status after marriage can be obtained by looking at the educational and occupational status of husbands of the married women. 64% of these women had husbands with equal or higher education and only 36.0% had lower educa-



tional status. In the group as a whole, 18% had husbands with higher qualifications of whom 12% had advanced science and technical degrees. The majority (65.6%) of married women had husbands with science or technology training. If science women are in general married to science men, this is very significant. In the West also it has been found that professional women marry men with higher professional accomplishments (Yogev 1983); which according to some, minimise jealousy. In India social conventions dictate that men must have a higher status than their wives, preferably. (Shukla 1981, D'Souza 1975).

Occupation wise also, these women had husbands who belong to the professions, a 33% being more or less in the same category while 76% had *higher managerial* positions. This is further confirmed by salary levels of husbands relative to wives. Only 11% of the husbands earned less than their wives and another 11% earned an equal amount but the remaining 78% earned more than their wives and 4/5 among them got more than Rs. 2000-2500. In addition, 40% of the husbands got substantially more benefits in addition to their salaries, benefits not available to their wives.

### Children

Small families seemed to be the norm. About two-thirds of the married women had two or less children, and only one-third had between 3 or 4. About 36.7% had children of pre-school age.

The women scientists' group had a sizable (38%) portion of unmarried women and young women (77% below 35 years) which suggests a late entry. Comparison with the educational level of parents and parents-in-law also suggest that the married women had married "lower" though their husbands had more or less equal educational level and were in science related professions. Most of the women, both married and unmarried reported a science background in their families, in contrast to earlier findings on men scientists. Highly educated women therefore tend to come from better endowed families whereas highly educated men need not. Higher education for women, and science education in particular seems to be *derived* from higher social status. Our findings corroborate similar findings of other studies on urban, educated women. Predictably, Hindus form the largest proportion. Christian women have middle level educated parents whereas those with least educated parents are Muslim women.

The Parsi women have the highest educational level in their families. Hindu women have a high spread – from low to high.

The educational status of the families could be important for influencing the support given to women scientists as well as influence their motivations and attitudes. In several places in the study this variable is brought in to see if there is any noticeable association.

## II

### **CAREER PREPARATION AND CAREER STATUS**

What is the kind of career preparation the woman have made and their actual career status at the time of the inquiry? Career preparation relates to educational qualifications, academic performance, special training and experience obtained, and careful subject choice. Did the choice of establishment have links with the subject area studied?

Preparation is also a question of motivation and concrete steps taken to realise objectives. Were proper plans made for a career in terms of what subject area, what kind of job, where etc.? Secondly, how earnestly did they try to get jobs, and what methods were pursued? What were the dominant motivations in seeking a job? Were these motives related to factors that influence career success and performance or were they related to reasons unrelated to career? Latter reasons could be personal preferences or other reasons such as location, timing, compatibility with other responsibilities and status considerations.

Career status is measured by post, salary, publications, recognition, awards etc.; promotion prospects, opportunities for upgrading skills, challenges in the job, job security, are all indicators that are used to sum up their position.

What were these women's own perceptions? Lastly, what exactly is career-involvement or commitment? Do women in general have less of it and is this a valid explanation of women's career status?

### **Educational Accomplishments**

Total number of B.Sc. were 47.5%, M.Sc. 45.0% and doctorates 7%. This proportion is different from the national level distribution. In the country as a whole, we had 2% doctorates, 31.3% M.Sc. and 66.5% B.Sc. (CSIR 1982) (Table 2.3).

**Table 2.3**  
**EDUCATIONAL LEVEL**

No. of Women	Level			Total B.Sc.
	B.Sc.	B.Sc.+ Diploma	B.Sc. + Second Degree	
Women	162	18	10	190
% of Total	40.5	4.5	2.5	
	M.Sc	M.Sc.+ Diploma	M.Sc. + a Second De- gree*	Total M.Sc.
Women	153	2	25	180
% of Total	38.25	0.5	6.25	
Women	Ph.D. 30			Grand Total 400
% of Total				100.0

\* B.Sc. or M.Sc. plus another degree like B.A/B.Lib./B.Ed. etc.

Our sample drawn from a metropolitan city with much higher levels of women's education would explain this.

Some 6% to 7% of the B.Sc. had gone in for additional qualification; of whom only 2% went in for additional science related diplomas, others having obtained diplomas in foreign languages or arts. The M.Sc. holders went in for diploma or degree in education or library science.

### Marriage and Education

Did marriage interrupt education? Out of the 190 who were B.Sc. degree holders, 102 had got married and did not continue. Of these 102, some 19 who did get married even before their B.Sc. managed to complete it. Of the others, 31 women had got married before they finished M.Sc. but completed their M.Sc., and 99 got married after M.Sc. but stopped there. Only five women continued to complete their Ph.D. In the whole group of married women, only 4 waited to complete their doctorates before seeking marriage. Whether the large number of B.Sc. holders would have pursued advanced degrees we do not know, but 238 women in the whole group had wanted more qualification. The reasons cited by them for their inability to fulfil their desires were: family objection (5.25%), household responsibility (21.50%), lack of

finance (6.50%). There were others who cited personal reasons and a few (8.75%) mentioned that *their organisations discouraged them*. That to a third of the group, there were hurdles because they were women does lend credence to the general feeling of unequal opportunities for women.

As between the different religious communities, we did not find any systematic differences in the qualifications of the women and the sample of Muslims and Parsis being very small (9 and 14) it is difficult to make out a case one way or the other. The post-graduates among the Hindus were slightly higher than in others.

### **Are These Woman Late Entrants?**

A plausible explanation often presumed for lower career status of women is the later entry of women. We do not, in the present study, have comparable groups of men to establish this. Cross sectional data in any case cannot give us a definitive answer for they present us only with post-hoc explanations. In our present sample, we do find that 75% had taken their first degree after 1960, and only 22% had earned their first degrees before 1960, and 3% had graduated before 1950. This result is to be expected as our age data shows and is in conformity with national enrolment data at college level.

Girls got better examination results in science than boys.\* The survey data however could not give us how many girls relative to boys obtain a first class, second class or third class and hence we have no way of judging whether the academic performance of the group is comparable or different to national data.

While 19.75% had consistently superior performance and 13.5% had consistently poor performance, the others (65.25%) had a moderately good performance. This by itself cannot pre-judge the issue of career status without matching for type and level of post.

About 90.75% had received no awards of any kind (prizes or scholarships). 8.75% had won prizes in college. Only 13 women (out of 400) had sat for National Science Talent Scholarship examination and 4 of them had won the scholarship. Of those who did not seek it at all, most of the women did not know of its existence (68.7%) and 11.0% had their school-college study before

Pass percentage as indicated in Education in India Volumes from 1949-50 till now consistently show at B.Sc., M.Sc., MBBS, BE level higher pass percentages for girls with an average difference of 7 to 8 percentage points.

these awards were instituted. Inadequate knowledge about existing opportunities is a serious handicap for women.

### Special Training

Did the women go for any special training/apprenticeship programmes? 75.75% did not take such training and 99.7% of the sample had no special experience that could increase their employment status. Of the few (97 in number i.e., a quarter of the group) who had acquired some training, 62 had it before they joined their organisation and the remaining 35 women had on the job training. Those who received training, were sponsored by their organisation and had received financial support during the period of training. In India only a few industrial and research organisations like BARC had such training programmes. The lack of such programmes on any scale limited opportunities for both men and women. Details of the training programmes revealed that the training referred to was more laboratory training at junior assistant level and while it may have helped women get a job, it was unlikely to take them higher. Only 14 women had received foreign training (CSIR 1979).

A very interesting fact was that 72% of our science women had received their degrees in Bombay. They had stayed on in Bombay after marriage and the new entrants to Bombay were few. If they had married within Bombay, the implications could be either that they had lost opportunities elsewhere or they had been able to retain their jobs and keep the continuity of their service. As we did not know anything about the former possibility, one could regard it as a gain in so far as they were able to continue in their job without suffering a loss.

### Subject Choice

Does the observed concentration of women in bio-sciences occur here also? Do we have the "feminine" subject syndrome (Table 2.4)

**Table 2.4**  
**SUBJECT CHOICE**

	<i>Maths/ Statistics</i>	<i>Physics</i>	<i>Chemistry</i>	<i>Biology</i>	<i>Geology</i>	<i>Pass Course</i>
Major subject graduate level	22	40	189	119	2	19
Subject at post-graduate level	17	30	86	68	3	—

Chemistry is the dominant choice, followed by biology. At present we have no clear evidence in terms of research to conclude whether women have less aptitude for the mathematical sciences. Studies abroad do not indicate "aptitude" because the lack of performance in tests could be due to lack of interest (Michael 1971)

What is the disadvantage of not being well-equipped in mathematical sciences? Would this imply: (a) inferior job opportunities; (b) cognitively less prestigious jobs within an occupation?

The following table from a CSIR study gives us some idea of unemployment by subject category (Table 2.5). There is an overall higher unemployment rate for women, but it seems less in physics. Are there fewer opportunities for prestige posts in chemistry and biology? We need to know more about this. While one cannot extrapolate from the group to a general population, to the extent the sample is scientifically drawn, we may be justified in doing so (Table 2.6). The mathematical science qualified women are more in teaching while the physics group is concentrated in research. Our chemistry-biology group is distributed more evenly in all sectors.

**Table 2.5**  
**UNEMPLOYMENT AMONG POSTGRADUATE SCIENTISTS (%) – 1975**

	<i>Agri- culture</i>	<i>Bota- ny</i>	<i>Zoo- logy</i>	<i>Chemis- try</i>	<i>Physics</i>	<i>Maths</i>	<i>Statist- ics</i>	<i>All Sciences</i>
Men	6.7	7.7	7.3	6.3	6.6	9.0	7.7	7.0
Women	15.4	20.0	23.5	16.0	13.1	21.8	17.1	20.2

Source: Nair, P.S. *et al* (1978) Post-graduate Scientists, CSIR  
(This refers to job seekers).

**Table 2.6**  
**WOMEN BY SUBJECT AND TYPE OF ESTABLISHMENT**

	<i>Teaching</i>	<i>Research</i>	<i>Industry</i>	<i>Service</i>
Maths/Statistics	12	7	3	22
Physics	9	30	0	1
Chemistry	48	52	37	52
Biology	47	23	17	32

This could be so because of the stage of development of our economy. The bio-sciences and chemical sciences have the widest range of applications. Mathematical sciences are required for fundamental research, nuclear development and computer technology all of which are in a nascent state in India.

While chemistry and biology have given women a diversity of employment options in this case, at the national level, women are poorly represented in the technical sciences and it is possible that this being a highly competitive field, it is less receptive to women. One needs to know what precisely are the superior job prospects of the technical sciences. A priori, one can argue that the frontier sciences are important for future growth of technology and the development of the economy so that while women may be getting adequate job opportunities as of now, their participation in future developments would get restricted.

Linking national unemployment rates with those employed in Bombay may not be valid as we do not know the unemployment rates for this region.

There is an important distinction between men and women in the choice of job (Table 2.7). Out of the 79 women who were first class students, 62 went in for teaching and research. In the case of men it is probably not true that the brightest go in for teaching and research, for monetary considerations may be more important in their case. Those who had done poorly (i.e., having managed only a third class throughout) are in service occupations. Part of the explanation of course is teaching/research posts require higher academic performance; but "industry" would have given them more monetary benefits.

**Table 2.7**  
**DISCIPLINE DISTRIBUTION OF RESEARCH SCIENTISTS**  
**(ALL INDIA DATA)**

	Women No. %	Men No. %	Total %
Earth/Space Sciences	15 (6.9)	202 (93.1)	217 (100)
Chemistry	19 (11.4)	148 (88.6)	167 (100)
Life Sciences	35 (31.5)	76 (68.5)	111 (100)
Agriculture	—	30 (100)	30 (100)
Medical Sciences	8 (25.8)	23 (74.2)	31 (100)
Technical Sciences	38 (7.0)	503 (93.0)	541 (100)
Social/Human Sciences	—	51 (100)	51 (100)

**Note:** Sample of 250 institutions from 600.

**Source:** Chakravarty, Radha, et. al. (1984) *The Status of Women Scientists in India*, NISTAD.

### **Career Preparation**

Educational qualifications and academic performance are to some extent predictors of future career possibilities and qualifications and career level. They are positively correlated though not always and there would be differences depending on the type of jobs or types of organisations one takes into account. While these are preliminary requisites to enter a career, success also depends on how well planned one's strategies are. Literature on women's employment often attribute lower job status of women to lower skills and or lower motivation. These may not be true of all groups of women. The general employment situation of the economy is an important determinant of opportunities. In a period of an all round expanding job opportunities the penalties for ad hocism may be few but if different sectors are expanding or contracting at different rates, an adequate knowledge of the market and prior planning will bring better rewards. In the West, researchers identified insufficient career guidance and counselling as an important reason why girls choose traditional subjects or end up in blind alley jobs [Harding 1983]. What is the level of effort made by women for getting jobs? Planning, motivation, effort are additional strengths in the employees's armour and would have some influence on an individual's career.

### **Motivation and Attitudes**

How seriously were they preparing for a career? There is a deep consciousness that the education and training they have acquired should not be "wasted". We work for "using our education" was a response echoed by 91.75% of the women. Economic gain was an additional motive, not the primary one. Barely 2.5% cited economic need as the *only* reason for their having taken up a job.

A bigger number than we expected declared that they had made "career" plans – 254 women (63.50%) while 143 women (35.75%) said they merely took up whatever came along. Those with B.Sc. and medical technology diplomas, had prepared for hospital jobs; the senior level teaching, or research persons had made a definite prior plan to go into these lines.

They were asked how they tried to get a job – did they answer advertisements, did they locate it on personal contact, did they register in employment exchanges? Hardly any had registered in the employment exchanges. Most of them had got



their jobs by answering advertisements; for teachers, personal contact was more important than advertisements.

It is not true that women always do inadequate career preparation. For this group of science women "career" *was important and anticipated*. We do not know in what sense "career" was interpreted. Our feeling is that they wanted to be engaged in doing some work, relevant to their education and training and visualised combining home and job when they got married. That they were career-oriented in the sense of being "ambitious" does not follow. Later responses to how they perceived their jobs confirm this suspicion. Choice of teaching and research may be due to both perceived advantages as well as availability. 41% had chosen their present job because they wanted that kind of work, while 45% had chosen their particular jobs because of both career and non-career reasons. Only 48 women (12%) would have liked something else but opted for what they got because of its suitability for their lives.

### **Career Status**

Rose (1956) defines career success thus. "A career would be considered successful if it had followed the patterns for the occupation reasonably closely, that is if advancement had occurred at about the usual times to about the usual positions in the hierarchy and with about the usual changes in income". This success would also mean that "a person has not only held his (sic) job, followed his (sic) occupation career steadily or even become famous but that he (sic) has generally derived satisfaction and pleasure from it".

This study tried to focus much more on objective indicators such as position, salary, productivity, chances for advancement, nature of the job, level of responsibility, degree of challenge, creativity etc. Respondents' perceptions are included but not used as an index. Were they able to use their education and training? How did they see their work environment? To what extent were their expectations fulfilled?

### **Job Hierarchy**

A common indicator visible and measurable is the level of post held and as a corollary, the salaries and other benefits that go with them. As the women were in different types of organisations, comparability and evaluation of their relative rank in the organisation was not easy. To overcome this difficulty a complete list of the 400 women and their posts and salaries for each estab-

shment covered in the survey was made. Many discussions were held with the respondents, the personnel managers, experts and the Indian Women Scientists' Association to arrive at the job ranking system in different types of establishments and we then attempted a broadly similar categorisation. We have used the type of establishment as the fundamental stratification but because a person's actual job may not coincide with the nature of the establishment, we have also taken note of the actual post held e.g., teaching, administration, research, technical, etc.

Possibility of upward mobility (Sinha 1973) makes a lot of difference to job status. This upward mobility is partly the function of years of experience, partly due to other factors. What are the promotion prospects and other related benefits of higher posts such as increase in power and authority? Studies abroad have shown that women "doing" research are often surrendering the fruits of their labour to their male superiors, or despite doing important work may be kept in subordinate and junior levels as "assistants". In research, superiors claiming co-authorship with younger colleagues without contributing in any way is a well known form of exploitation; in such cases juniors dare not protest for fear that even minimum facilities may be withdrawn. Teachers may be afraid to launch innovative programmes as they risk antagonising colleagues who feel threatened that their set pattern of work may get exposed. These are the organisational ponderables in any setting. A survey cannot capture these innuendoes and invisible traps. Nevertheless some kind of a broad assessment can be made with the quantitative and qualitative data from this survey.

"Achievement", "performance" are loaded words. If a person's job level is low it does not necessarily follow that her/his "achievement" is low. There may be psychological dimensions such as the degree of involvement, the identification one has with the objectives and goals of the establishment etc. There may be achievement in the sense of published work, good teaching or a job "well done". It is not always that good work is rewarded. The innocuous sounding if vague phrase "status" has been chosen here studiously to bring home the idea that we are evaluating women's relative status as a group and not individual successes or failures as a personal measure.

There may organisational features that may inhibit *both* men and women. Research on scientific organisations have been

concerned with whether the milieu in organisations is conducive to scientific creativity (Morehouse, 1971). Yogendra Singh (1973) talks of hierarchy as the basic principle of Hindu ethos that permeates all institutions. Surjit Sinha (1973) also remarks that the guru-shishya tradition often results in obsequence to elders, regardless of younger man's merit, of an ethos of subservience whereas challenge is what is necessary for progress. Bureaucratisation or hierarchic-ethos are larger issues. We cannot ignore them because one will have to differentiate the gender effect from the overall effect on *all* scientists. This requires a detailed study of individual organisations, something beyond the scope of this book.

The following data attempts to gauge these various dimensions of career and to what extent their success or lack of it lies within the organisation.

### Level and Type of Post

Though four broad categories of establishments had been taken, the individuals may have different functions within them, so here the post held irrespective of the nature of the organisation is taken.

**Table 2.8**  
**POSTS HELD**

	<i>Teaching</i>	<i>Research</i>	<i>Technical</i>	<i>Adminis- tration</i>	<i>Not stated</i>	<i>Total</i>
Number of Women	115	134	102	47	2	400
Percentage of Total	(28.75)	(33.50)	(25.50)	(11.75)	(0.50)	(100)

The biggest group was in research, followed by teaching (Table 2.8). Within each category, the level varied. Among the teachers, over 73% were at the lowest level; in research they were somewhat better but even here only 12% were at higher levels but these posts were not the "highest" in the establishment; those who were at the top in the sample were still at the *bottom* of the top level in the organisation and *there was not a single woman in any policy making level*. A few technical women who had a higher designation and salary level in the sample were also not at the top in their organisation. In administration also, they were very few at higher levels and the biggest group was at lower levels. Desig-

**Table 2.9**  
**WOMEN BY LEVEL OF POST**

Teaching	Research		Technical		Administration		Total		
	W	%T	W	%T	W	%T			
Prof./Head Dept.	1	0.8	Director	—	Director	—	—		
Professor	3	2.6	Div. Head	—	Dept. Director	—	—		
Assoc. Prof.	2	1.7	Sr. Sc. Officer	—	Dev. Officer	1	1.0		
Asst. Prof.	3	2.6	Post Doct. Fel- low	—	Res. Officer	8	8.0		
Reader	—	—	Middle Sc. Officer	—	Sys. Analyst	14	13.7		
Lecturer	22	19.1	Lower Level Sc. Officer	—	Sr. Lab. Tech.	41	40.1		
Demonstrator & Jr. College Lecturer	84	73.2	Res. Asst.	—	Jr. Lab. Tech.	20	19.6		
			Tech. Asst.	10	7.5	Technician (operative)	15	14.6	
						Head Clerk	9	19.1	
						UDC/LDC	13	27.6	
						Steno	5	10.6	
Total	115	100	134	100	102	100	47	100	400

nation by itself was no indication of the actual work done. Though 2/3 of our sample was in teaching—research we found only 40% doing actual teaching or research – the others were doing more routine work. Another 6.25% at higher levels were doing administrative work connected with their departments.

This agrees with other findings at national level; the CSIR study on R & D establishments where 60% women were doing auxiliary work; likewise in Chakravarty's work nearly 50% were in less creative, less analytical work within research.

When had they taken up their *first* job? 90 women had done so 1-2 years ago; 93 had done so 3-6 years ago; 69 women had entered 7-10 years ago; 53 had done so 11-14 years ago; 46 had come 15-18 years ago and 27 women had worked for over 20 years. This meant that nearly 2/3 had come in less than few years ago. More immediately relevant for promotion was their experience in the current job.

Recent entry is an important explanatory factor for many of the women for low position but it is not an explanation for those with 15-20 years.

If we consider the total job experience of the women, including all previous job history, we get a fairly significant proportion of women with over 10 years of experience (32.25%) of whom 16% had worked in all for more than 15-20 years but very few of them had reached the top posts in their organisations.

### **Experience in Present Job and Salary Levels**

The mean salary levels was calculated for years of experience in each category of establishments and these figures are given below (Table 2.10)

Research scientists began better but did not rise high whereas in industry, upper levels were higher. Service establishments offered least rewards because they were dead-end jobs and lower level jobs. Teaching came in between.

### **Physical Conditions**

As far as physical conditions were considered such as total working hours, opening, closing time, transport difficulties or workload, hardly any respondent had cause for complaint.

**Table 2.10**  
**MEAN SALARY AND YEARS OF EXPERIENCE BY TYPE OF ESTABLISHMENT (RS. PER MONTH)\***

	Years							Total
	1-2	3-6	7-10	11-14	15-18	20+	Not Stated	
Mean Salary								
Teaching	690 (30)	856 (22)	893 (35)	1070 (20)	1095 (9)	916 (3)	650 (1)	(120)
Research	1038 (23)	1107 (65)	953 (19)	1028 (9)	1625 (4)	— (4)	1025 (4)	(124)
Industry	969 (16)	1133 (24)	1490 (10)	1688 (8)	2000 (2)	1484 (3)	1750 (2)	(65)
Service	614 (22)	700 (44)	695 (20)	700 (4)	—	—	550 (1)	(91)

*Note:* Figures in brackets indicate the number of women.

\* These salary levels relate to 1976-79; since then money incomes have gone up all over for the salaried class.

### Promotion

Promotion is part of the built-in reward system of an organisation and to a large extent is a structural constraint. Some posts have less prospects than others but taking these into account, do the potentially available chances accrue in equal measure to women as much as they do to men?

Promotion was studied from the following main points:

- (1) Were they placed in cadres that had upward mobility?
- (2) Where such mobility was possible, when had they received their last promotion?
- (3) When was their next promotion due?

245 women (61.25%) asserted that promotion avenues did exist in their job yet more than half had not received any so far. For those who had received promotion, it was after 5 years and in some cases 10 years or more, after taking into account seniority and vacancy. Some 19% women did not know whether their jobs had any promotion prospects and of those who knew (68%) had no idea when there would be any promotion for them.

Job security is quite often a more important consideration than rank or salary. 70.25% women held permanent posts and another 20% expected to be made permanent. This is a positive

factor. (Various other studies have also shown that both men and women in India rate job security highest).

Aside from the statutory benefits to women (such as maternity) none of the women received any special facilities as women. A sense of fulfilment may be derived from the nature of the job despite lower rank or salary if there was scope for initiative and leadership. Detailed questions were posed on what exactly did their jobs involve and from these was derived some measure of the extent of leadership and initiative they obtained.

**Table 2.11**  
**SCOPE FOR LEADERSHIP AND INITIATIVE**

	<i>Leadership</i>		<i>Initiative</i>	
	<i>No. of Women</i>	<i>%</i>	<i>No. of Women</i>	<i>%</i>
Very little	18	4.5	22	5.5
To some extent	50	12.5	78	19.5
Considerable	45	11.3	84	21.0
None	287	72.7	216	54.0
Total	400	100.0	400	100.0

In explaining the scope their jobs offered for leadership and initiative it was found that those tasks that involved routine carrying out and required no supervision were graded as having little scope. Clerical jobs, laboratory assistants work belonged to such a category. Lecturers had freedom in teaching methods but had very little say in the policy making decisions of the college where they worked. Research officers enjoyed some discretion in selecting and conducting research projects but approval and sanction of grants, research programme area etc depended on higher authorities. Supervisory laboratory staff have some say in indenting materials and equipment but did so within the budget allocation of the department. The few women who were in executive positions described their work as requiring leadership. In sum, the majority 72.7% felt they had no opportunities for leadership and more than half experienced very little scope for initiative.

### **Publications**

Achievement and involvement in science (especially teaching and research) is judged by publications. According to CSIR the overwhelming number of both men and women in India do not

publish books but only papers. Of the total publications in India as a whole, 25% come from scientists in medicine and agriculture. This is the consequence really of the fact that 50% of our R & D allocation of funds go to agriculture and medicine. Universities accounted for 39% and more than 60% were in the form of papers. India has 2.3% of scientific authors in the world but we have the eighth place with respect to the total number of authors among all countries who contribute to scientific literature. That is measure of achievement at national level.

In our group 70.3% did not publish anything. There were 24 women who had a good output, and some 9 women had published more than 20 papers. We must see publications in the context of their job (Table 2.12). It is mainly in teaching and research where it is obligatory.

**Table 2.12**  
**PUBLICATION BY POST**

<i>Type of Post</i>	<i>Women with Publication</i>		<i>Total No. of Women in the Post</i>
	<i>W</i>	<i>%</i>	
Teaching	21	18.6	115
Research	80	59.7	134
Technical	15	14.7	102
Administrative	3	6.4	47

Some 16 women had written general articles, but even these were more in research. The record of teachers was not inspiring (and this would be true of men teachers also) and though research scientists have done better but compared to their total number, it was not as good as it could have been. Understandably, in teaching, those who published papers were the senior ones. Five out of nine women who were in the post of a professor had a few papers to their credit. At middle and lower level, there was only a stray exceptional woman who had one or two papers. In research, fifteen out of the sixteen women at higher levels had papers (but only half of them had more than 7); at middle level, 29 women out of the 45 occupying middle level had two or three papers, in 4 or 5 cases more than 5-8 papers. At the lowest level of research, (the assistant level) the record was not bad, some 36 persons (nearly half) had a couple of papers. In the technical posts on the contrary, it was the middle level and lower level who had contributed more. In administration, only the



higher level women had anything, but in any case the total number of women who published anything among the administration was only 3 out of 47 women.

### **Influence of Age**

Age wise it is the age group 26-35 that had published the maximum and marital status did not make any difference; if anything the married women did better (Table 2.13).

**Table 2.13**  
**NUMBER OF PUBLICATIONS BY MARITAL STATUS**

<i>Marital Status</i>	<i>No. of Women with Scientific Papers</i>	<i>Total No. of Women</i>
Unmarried	37 (24.6)	150
Married	79 (33.5)	239
Divorced/Widowed	3 (27.7)	11
Total	119	400

Educational level made an important difference to their publishing effort because while 24 out of the 30 Ph.Ds. (80%) published papers and books, and 72 out of 180, did so among the M.Sc. women (i.e., 40.0%), among the B.Sc. women there were only 23 (2.1%).

It is often thought that career status is affected by marriage. We saw that married women were equally or more productive but did they hold higher or lower posts on the whole?

The married women, in general did not have a "lower" career status (Table 2.14). Marriage as such, it appears, is not an obstacle. However, there were age variations; the majority of the unmarried were younger and promotions accrued more at senior age levels.

### **Conclusions Regarding Career Status**

What can we say about the career status of these science women, gathering together the dispersed evidence in this section? We saw they are predominantly in teaching and research, where monetary rewards are modest as compared to other occupations though they may carry prestige; but within the possibilities these occupations offer, the women have only gone half way up — in teaching, 73% are below lecturer level, in research 55% are at very junior levels and in technical posts 36% are at the

**Table 2.14**  
**WOMEN IN DIFFERENT POSTS BY MARITAL STATUS (%)**

	<i>Unmarried</i>				<i>Married</i>			
	<i>Teach- ing</i>	<i>Rese- arch</i>	<i>Tech.</i>	<i>Admn.</i>	<i>Teach- ing</i>	<i>Rese- arch</i>	<i>Tech.</i>	<i>Admn.</i>
Higher level	6.6	29.0	16.4	9.5	7.5	46.6	28.8	8.3
Middle level	20.0	21.2	65.4	47.6	18.8	17.7	42.2	50.0
Lower level	73.4	49.8	18.2	47.9	74.7	35.6	29.9	42.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

lower rungs. On the positive side, almost all of them have job security. Qualitatively speaking very few are in posts that carry other rewards such as leadership and autonomy. Promotions are rare and if they come at all, come after few years and that also not always to the top. Productivity and creativity as judged by publications is also very modest but those who have done creditable work are those at higher levels.

### **Career Attitude**

In literature on women, there is a great deal of concern regarding the self-perceptions of women and self-image of the women employees. Their subordinate status it is argued is because of the "lack of push" or lack of assertiveness by the women.

In the West, Matina Horner (1969) after her discovery of how women's "achievement" level was low, coined the term "fear of success" to denote what seemed deliberate avoidance by women of the pursuit of success in order to minimise social disapproval or rejection or rather minimise male rejection. Alternately, it is hypothesized women "reduce" aspirations in order to cope with their dual burdens or because they give primacy to their familial roles, and career status is of secondary importance in their reckoning. Before examining the implications of these theories and explanations, let us first see the evidence regarding the level of aspirations in our data and how it compares with findings of other professional group of women in India.

According to objective criteria the women in this group were well qualified with nearly two thirds having had post-graduate training. A few of them had additional degrees and diplomas. 306

women (i.e., 76.5%) felt that their job was equal to their qualification; 13% thought they had got more than they deserved and only 19% thought their qualifications were higher relative to their jobs; and these were distributed at all levels of education, the highest number of dissatisfied coming from the M.Sc.s.

Dissatisfaction often comes from a feeling of non-utilisation of one's training and experience. 210 women (52.5%) felt they were using their education and training *fully* and 171 (42.75%) felt they were doing so partly. Of the entire group 18 women, (4.5%) were positive that they were not using their education and training at all.

We cannot conclude anything straightaway from this. With a plentiful supply of persons with college level education, over-qualification for many jobs is inevitable and this may apply to all persons but there is a likelihood that this applies much more to women if we can draw some conclusions from other studies which show women employees to be better qualified on the average. The reward system in an occupation may be both concrete and intangible. The intangibles may include many factors.

Job satisfaction has several components: (a) material benefits; (b) social prestige; (c) equitable relation between effort and reward; (d) suitability and interest of the work; (e) pride in the product of the establishment; (f) promising career prospects; (g) pleasant human relations; (h) ability to control the flow and pace of work; (i) congenial working conditions. Most sociological studies point to two main factors, no matter which particular aspect of job satisfaction is taken — educational attainment and age level. Usually the higher the level of education, the greater the tendency to dissatisfaction because their job encompasses many dimensions. Secondly, the longer the job experience, the greater the adaptation to the work situation and less the influence of pre-work expectations. Beginners tend to overestimate the real possibilities of the labour market. Amongst the most high placed, control over flow and pace of work and sense of authority is prized most and monetary rewards are placed lower.

The respondents were asked how they were rewarded (Table 2.15) The responses tell their own story.

If we include those that received no recognition and those who received only praise, 245 women (61.25%) received no recognition at all or only figurative pats on the back.

**Table 2.15**  
**MANNER OF RECOGNITION GIVEN**

	<i>By praise</i>	<i>By promot- ion</i>	<i>By in- clusion in policy making</i>	<i>By re- commen- dation for higher post</i>	<i>All ways</i>	<i>No re- cogni- tion</i>	<i>Total</i>
No. of Women	127	74	57	13	11	118	400
Percent- age	31.75	18.5	14.25	3.25	2.75	29.50	100.0

Granting all these factors, how did the women themselves view their status? Nearly half (49.5%) declared they were completely satisfied. Of those who were partly satisfied the dissatisfaction related to their not having obtained more qualifications rather than with the treatment in the organisation. Others (18%) placed the source squarely at the establishment — lack of promotion, routine jobs. The acutely dissatisfied were irked by the absence of a challenge in the job, lack of recognition and absence of chances for getting more knowledge and experience. No less than 50 women clearly mentioning lack of promotion, is evidence that there was a distinct group which was aware of their low status, even though they were not negative in their assessment.

Did the level of post have something to do with satisfaction? Teachers and researchers at lower levels were dissatisfied with their progress and status; in administration what made them unhappy was the routineness of the job. At an overall level, the level of satisfaction by level of post held was 66% teachers, 48.5% research scientists, 46.8% among administrative cadre, 54.9% among technical staff. That research scientists were not satisfied is a significant commentary on the inadequate opportunities they get and their higher level of aspirations.

### **Aspirations**

It is important to know not merely whether they were satisfied or dissatisfied and why but also what kind of things they actually desired. What kind of jobs would they have liked to have, if they had an option?

213 women (the majority) wanted a job that was more *interesting and challenging*; 59 wanted more responsibility; 33 wanted

**Table 2.16**  
**REACTION TO CAREER STATUS**

	Satisfied	Want more degrees	Progress not equal to qualification	Dissatisfied with nature of job	No response	Total women in each category
<b>Teaching</b>						
Higher level	4	—	—	—	—	4
Middle level	14	8	2	1	2	27
Lower level	50	22	12	6	4	84
	68	30	14	7	6	115
<b>Research</b>						
Higher level	8	2	1	1	1	13
Middle level	36	21	7	—	8	72
Lower level	21	1	10	3	6	49
	65	24	18	4	15	134
<b>Administration</b>						
Higher level	2	—	—	—	1	3
Middle level	6	4	—	1	1	12
Lower level	14	5	7	4	1	32
	22	9	7	5	3	47
<b>Technical</b>						
Higher level	1	—	—	—	—	1
Middle level	10	4	4	2	2	22
Lower level	45	13	13	4	4	79
	56	17	17	6	6	102

more leisure; 49 wanted interesting, challenging and responsible posts but *only* 33 wanted more pay.

If their jobs were not rewarding, could they have sought better jobs outside? 70% had not applied elsewhere. However, while they did not try vigorously to seek improvement, *it is not true that women always refuse promotion to avoid taking responsibility*. Only 5 women had done so, because they had small children and 2 because it involved transfer. The overwhelming majority had never turned down chances of betterment.

### Collective Struggles

Professional status can be strengthened by active participation in collective struggles and in professional associations. Only 30% were members of their unions as members only and did not attend meetings. For such a large body of teachers and researchers hardly 8% took some sort of interest in professional organisations. This corroborates other studies too where participation of women in collective organisations was low. (Seetharamu 1981). We should also remember that for Indian men scientists also, this holds good. Only 30% men were members of scientific societies. The reason given by women were not domestic responsibilities but: (a) they were not interested; (b) there was too much "politics" in it.

### Career Continuity

Barring a small group which had special problems, the majority had kept their jobs (Table 2.17). Those who had breaks were older women. More married women now enter jobs and *retain* them. Perhaps this has also something to do with difficulty of finding jobs and the more highly competitive milieu we find ourselves in today. Even the unmarried wanted to continue working; some of them were not sure how marriage would intervene, but even among the unmarried 16% said categorically they would work *no matter what happened*. Women do not throw up a job that easily. We found most of the breaks were because the jobs were temporary i.e., involuntary.

Another index of continuity is job changes. 180 women had never changed; 142 had changed to get better prospects. Of those who had changed jobs, 11 said it was because their previous jobs had been terminated; 4 had got promotion; 15 had left to do research and 37 had left jobs for family and personal reasons. Once again, the myths about women's lack of labour market attachment proves false.

**Table 2.17**  
**BREAKS**

	No. of Women	Breaks by Post/Marital Status			Total No. of Women in the Post
			Unmarried	Married	
No break in career	313				
Break before marriage	17	Teaching	2	11	115
Break after marriage	17	Research	8	19	134
Break after first child	6	Administration	—	7	47
Unmarried	18	Technical	7	3	102
Only recently joined	59	Total	17	40	400

How did these job changes affect their status? Did they really improve their chances? (We are referring to job changes made before they took up the present one). Some 92 women merely moved horizontally (23%) while 27 had moved up; 92 moved to a totally new job or different job and to 189 women this was the first job.

Some 164 women (41%) had never changed jobs; 107 (26.75%) had changed once and 27 (6.75%) had changed twice and 29 (7.25%) had changed thrice and 12 had changed more than thrice.

Very few women expressed any need for strong women's organisations to meet the special needs of women. Nor did they think any special facilities were necessary beyond maternity benefits. But 82 women (20.5%) *emphasized strongly the need for child care facilities as a prime necessity*. There was no significant difference in motivation between the married and unmarried. In fact union membership, membership of professional organisations, participation in meetings etc. were all *higher* for married women. This could also be due to their longer exposure to their career. What surfaced repeatedly in several places during this survey was that there is no evidence that generally marriages "obstruct" careers.

### Summing Up

The aspirations of the group as a whole were modest for salary/post benefits but a minority had strongly felt that they did not get their just deserts; however, there was some awareness of missed chances and persistent inequalities among those who were partly satisfied. Intellectual challenge seemed to have been of primary concern; and their compliance with their status quo follows logically from their dominant motive to work being "use education" rather than strive for equality or achieve their fullest potential. We should not ignore the 59 women who were more aspiring and desired responsible posts. We are witnessing perhaps the slow emergence of consciousness in women on their rights and a hesitant reaching out to equality in a section of the women. Often the majority cloud the significance of the minority group. In a new profession like that of science the presence of this small group cannot be easily dismissed.

There is a fallacy in pointing to low aspirations as the cause for poor career status – that low aspirations are due to their "nature" (conditioned or whatever). The application of achievement/aspiration etc. outside concrete contexts in a purely abstract way is not meaningful.

In one sense, while we can *understand* the behaviour of professional women here and agree that it is invalid to compare it with men in the judgmental way in which it is often done, we are still left with the problem of how in future would women improve their status. Unions and professional associations are themselves structured in ways not suitable for women's participation. If they can evolve their own participatory styles, if they can develop their own organisations, inequality in career status has a chance of being confronted. It cannot be done by individual high scores on motivation, achievement, aspiration etc.

## III

### FAMILY ENVIRONMENT

This section examines the overall family environment of the women and tries to see what sort of encouragement was given for education in science and a career in science; whether they were discriminated against as daughters as against sons for facilities and opportunities; whether the encouragement by the family was reflected in the choice of establishment for employment; the ex-



tent of household responsibility and child care responsibilities these women had; whether they received any assistance from other family members; who controlled their income.

In the case of married women their husbands' attitudes and cooperation were examined and also whether the occupation and educational level of husbands relative to their wives made a difference.

Women's position and responsibilities in the family, their rights, obligations etc. have a crucial influence on their overall status as well as the effectiveness of their lives in spheres outside the home. It is difficult to go deeply into the family dynamics in a study based on survey methods, but we try to assess in a general way, whether the families of these women have been supportive or restrictive in providing the resources (material and non-material) needed for entering a career and the continuing encouragement needed for pursuing a career. Individual women's motives and attitudes are immediate and proximate influences but these attitudes are themselves subject to the family background. In addition to the values the family holds there are objective conditions that are conducive or inhibitive for women; the workload at home, the nature of the responsibilities, time availability, and expectations or demands the family places on them.

In the matter of education, whether a positive encouragement was given and whether they received equal or discriminatory treatment as compared to their brothers set the initial pace. For married women, the attitude and behaviour of husbands and in-laws are extremely important and in fact in-laws' responses may overrule possible support from husbands in the Indian family tradition where sons wield little direct influence over their fathers or mothers. If staying alone in a nuclear family set-up, husbands may play a decisive role. They may be supportive or antagonistic to their wives pursuing a career beyond certain limits. The men's own ambitions for their own careers may take primacy and their wives' ambitions discouraged in the "interests of the family". If the husbands on the other hand have no major career interests they may demand more wifely attention because their source of fulfilment, then lies in the domestic sphere; it may be a channel of ego fulfilment when work does not engage them to provide such self-esteem. Domination at home becomes a compensation. Many of the psychological problems of

personality development for Indian men are thought to lie in the lack of autonomy and the high degree of dependence created on the mother (Kakar 1978). Compensatory behaviour by domination of some one whom society grants an inferior status becomes a legitimate experience of power.

We also do not know much about the nature of the relationship between these women and their fathers and mothers. We have tried to see whether fathers in the case of these women, provided encouragement and instilled a desire to achieve.

In Western literature, the mother's role is perceived as a conflicting and a contradictory one. We really do not have much information on how far this is relevant in India. Powerful macroforces have altered conditions resulting in revision of many norms. Late marriages and the desire for maintaining or improving one's standard of living, smaller families are all developments that have in some ways loosened the controls on women for this class. Changes in family due to urbanisation has been documented by others such as Kapadia (1955), Gore (1968), Ross (1961).

We examine briefly the objective situation of the family environment through inquiries into: (i) who provided motivation, (ii) whether marriage results in breaks, (iii) what is the extent of their responsibilities at home and how much support or sharing others give them, (iv) what are others' expectations from them, and (v) does the educational level of family members make a difference.

Some inferences from the 30 case histories are also drawn to see whether the family environment influenced motivation and choice and what factors helped their progress. Respondents' assessment may be coloured by subjective factors; by getting details on various aspects, some kind of objective assessment beyond saying respondents "think so" perhaps is possible.

### **Encouragement to Education and Career**

Who had given them backing? To 144 women, it was the father, to 29 women, it was the mother; to 30 women both parents and to others it was teachers, friends, brothers or oneself. While 168 women said they chose science on their own, the fact that they have completed their courses speaks for support for their choice. By and large the father was the most important influence. In our indepth interviews, a few women mentioned that their fathers had overruled their mothers' anxiety

to get them married and allowed them to go in for post-graduate studies. Among the M.Sc. and Ph.Ds. this father support was clear but they also had strong ambitions of their own.

### **Discrimination**

Discrimination may not be consciously practiced. Some parameters might indicate such unconscious discrimination. The rule seems to be that girls are expected to do more housework than boys. This must have cut into their free time or play or other activities. Secondly, girls are condoned more for lack of good performance. There were three or four women who said their parents did not spare funds for their medical education but gave preference to the sons. The group as a whole did receive a congenial, supportive atmosphere.

As far as career plans were concerned, the more educated parents induced their daughters to make a definite career plan. Among the 280 women who declared that they had made plans to work, a large number had highly educated parents. Among the 26 women who "perceived" discrimination of some sort or the other, a few were M.Sc.s. This might mean that they were ambitious to start with and hence sensitive to discrimination. Equal treatment between sons and daughters did not in all cases emerge as unconditional.

### **Attitude to Employment**

Usually more reservations are expressed with respect to a girl's employment than with education. Here too, there was a substantial measure of support. 255 women (63.7%) had received positive encouragement from both parents (and in-laws) and 103 women's employment (25.7%) were accepted. Actual opposition was faced only by 10 women in the sample of 400. The employment of middle-class women has indeed come to be accepted and "decision" to work is no longer a problem area (Rao 1965).

Has this impressive support something to do with the nature of the job? The differences as between the four types of establishments were marginal because they were all white-collar, learned professions.

Approval for employment did not seem to depend on the nature of the establishment. It was found that for the women employed in industry, which is a less traditional sector than teaching or research, considerable positive encouragement ap-

pears to have been given by their families. There are only ten cases where the families were *opposed* to their employment and the reasons could lie in other special family circumstances.

### **Role of the Husband**

Married women were an important segment in the sample and hence it was important to see the attitude and cooperation of husbands. The questions asked were whether the husbands complained that they or the children were neglected. Half of the married women reported that their husbands did not think that their needs or their children's needs were in any way neglected; 73 women said the husbands cribbed about children not being properly looked after and 38 women's husbands felt that theirs as well as the children's needs were inadequately met while only 4 women's husbands complained of inadequate attention to themselves. Women's employment is accepted but even in our sample, for the married women, the expectations still linger that they should look after children. Except for a minority, however, the change in attitude on the part of husbands appear to be that they demand less "wisely" services than they might otherwise. A group of men, though in a minority, did demand wisely services. Gandhi (1958) had rebuked young men who were adult enough to take care of themselves but demanded personal services from wives.

There were 169 women who also said their husbands helped in house work, took interest in their wives' professional work. Another 58 women said their husbands accepted their wives' employment. Unmarried women and single women generally stayed with parents and the former did not have much work at home.

In the previous section, we had noted many husbands reported feeling "deprived" or they perceived their children as "deprived" of mother's attention. Yet the women declared their husbands were "supportive" "encouraging" etc. There is an ambivalence here. As Huber and Spitzze (1980) say, nicely developed ideologies occur among the educated. Wives do market work because the "family" needs money. Husbands do a little bit of house work to enable the household to function. The approval of married women's employment increases because both spouses are uncomfortably aware of the inconsistency in belief and behaviour. The wife has acquired the same level of education as the man. Yet the adjustments made for family comfort does not require any major shifts on issues related to women's liberation

(e.g., sexual division of labour). It is easy for both not to see them as related. For the sexual division of labour to change and for women to gain greater autonomy, other changes must happen in people's lives that will force them to confront the issues.

We can see the ambivalence in the spouse's attitude when we breakdown the answers by their educational level and occupational level relative to their wives. Older men (i.e., who were much older than their wives) were more supportive than younger men; the more highly educated men were less supportive; men who were in the same occupation as their wives *were least helpful*. In such cases there does seem to be an element of competition and consequently some feelings of insecurity among the husbands.

What is the extent of responsibility for different tasks for married women? Cooking, taking care of guests appear to be more the women's responsibility. They have less responsibility for marketing. While much more detailed time allocation study that also captures the nature of the tasks done by different members of the family would be more useful, even within this limited study we see the domestic burden for these women. To what extent did marriage and children slow down their career? It seemed to depend very much on what arrangements were available for child care and house work. 159 women had some relatives at home; for 89 women, others at home did the entire managing; 61 women managed with the help of servants, children and husbands. Only 30 women had to forego career benefits (16 because of home responsibilities, 3 surrendered better job prospects and 3 lost chances of improvement because of the uncooperative attitude of husbands).

Marriage and career combination no longer pose insurmountable problems but to a group of women who cannot make arrangements it still does. In rare cases, recalcitrant spouses can pose impediments. Marriage and family can also pose other problems. Eighteen women changed jobs because of marriage and thereby suffered a break in career; three because of young children.

While marriage as such did not come in the way of their working outside the home, children created special difficulties. 60 women could not stay back late in the office to do extra work or extra research. Out of 177 women who had children, 72 said they had no difficulties. Once again it depends on the nature of

work. Research requires far more commitment than others. Historically, the removal of production from the home and the withdrawal of children from production has in advanced industrial countries and in industrialising countries such as ours, made child care more and more the exclusive responsibility of women (Phillipson 1982).

The possibility of pursuing a career wholeheartedly (not merely keeping a job) occurs when support is available in the family (in-laws, parents, other relatives) who take the major burden of running the household. The Indian family structure and the availability of domestic servants (plus facilities like gas, pressure cooker) have made the passage easier for middle-class women.

Nevertheless the sexual division of labour persists. This is revealed by the deep anxiety and responsibility felt by the women for children and family. More women felt they could not attend to the family than the number of women who felt they could not attend to their work. We are not saying they were less "committed" to their work. They were perhaps conscientious, (in fact most employers find them so) but not ambitious. We are not in a position to pronounce judgements without knowing what kind of situations at home produced anxiety. Attitude to career depends a lot on the job. We found more junior level women such as laboratory assistants dissatisfied with their job. Secondly, as we saw earlier, the necessity to balance different needs and expectations produce a different optimum than a singleminded pursuit of only one goal, namely a career.

Their commitment to the family also comes out in the use of their income and their control over it.

The kinship system is not just a set of moral principles but is rooted in material condition (Dube 1980). It is really a set of principles that govern the distribution and control of resources within and between socio-economic classes. Within a kinship unit, regardless of class, women and men may not have equal access to and control over resources. Employment of women has given them additional resources but they put it at the disposal of the family, first and foremost.

The "family attachment" has a material cause. In the absence of other welfare benefits the family is the only institution that provides support and security. Development involves break-

ing down of some clearly laid norms of the older order and creates moral uncertainty and a feeling of being on their own. While it releases them from the tyranny of tradition, it imposes a heavy moral burden. For women there is first the uncertainty of a new sphere. To this, one would not like to create new uncertainties by challenging things at home.

There are many who argue that individualism is alien to Asian societies which are group oriented. In Western literature, there is an overemphasis on independence as a criterion of mental health. In Asian societies, the egoistic, competitive need achievement of alienating individualism, it is claimed, is replaced by "a more harmonious reciprocal individualism" (Rottenburg 1977) Perhaps this is too idealised a version. In any case, the family does not exist in isolation. Processes of reproduction (physical and social) are tuned to the prevailing mode of production. Competitive market economy would generate competitive pressures. The family in India serves a dual function: it serves to cushion shocks; it also coerces.

In fact, a great deal that is happening in Asian societies today has much less to do with Westernisation and much more to do with industrialisation and urbanisation. We do not have much idea of what really constituted the traditional family, who lived in it and whether it was the same everywhere. Likewise the history of prolonged anticolonial political struggle in which women played an important part and a religious system (such as Hinduism) which can accommodate a fair degree of change than one which has a more monolithic, theocratic ideal — these are all forces that have been at work to increase opportunities for women (Ward 1963) — though not uniformly for all classes.

### **Some Patterns Gleaned from Case Histories**

We had selected 30 cases, 15 high achievers and 15 low achievers, to find out more about family environment and their attitude to science and discuss briefly below the salient points that emerged regarding family environment.

Among the high achievers (i.e., defined by post/salary) we found two categories of women (i) those who were deeply involved in the intellectual challenge of their work, and (ii) those to whom monetary benefit came first. The former had come from a background where the parents were greatly interested in academic excellence; in the latter the parents were not so highly motivated. It

was not the economic circumstances that mattered but the value system.

Among the low-achievers, many had to take up a job immediately to earn and had to help their families. In one case, because of an accident which crippled her, the woman took up a job which was easier. All of them talked of "supportive" families. There was however one woman who broke off with her family and had to fend for herself. She faced child care problems. There was another case of a divorcee whose husband did not give any economic support and so she preferred a stenographer's job in a company that would pay well. Thus, the reasons for choice of job in this group were partly personal problems and partly due to family circumstances.

While one can talk broadly of "family-support", it requires a great deal more of information both with regard to work schedules in the house and work schedules at place of work and comparative data for men and women on both counts to be able to come to any categorical statements. We can say their families help them to keep their jobs — whether it is possible for these women to push ahead, under their given circumstances is not so clear. Partial evidence here seems to suggest that it was not easy for many of them.

## **IV**

### **EFFECT OF ORGANISATION**

Are there marked differences between the different types of organisation represented here with respect to career opportunities and work-conditions? We examine whether: (i) the career status (i.e., level of post and salary), (ii) prospects for improvement, (iii) training facilities, (iv) opportunities for using one's education and training, and (v) recognition given, vary as between public/private sector; as between different types of establishments (teaching, research, industry, service) and lastly according to size of units.

Pay scales and service rules are fairly standardised in the public sector, though there may be greater variations in the private sector. Size of the unit may be an important factor in the relative degree of bureaucratisation, flexibility or rigidity and the level of autonomy or initiative permitted. The functional orientation of the establishment also sets its own tone and the rhythm of work, time schedules, job hierarchies, career rungs etc. are all



shaped thereby. Teaching establishments have their own typical structures: similarly, research organisations. Most of our service establishments are hospitals and hospital administration with their own peculiarities (such as more "emergency" situations) in the interaction between patients and hospital staff and so on. Our industrial units are pharmaceutical companies, many of them multinationals. As this study is not focussed really in unravelling organisational styles and their impact on employees, which is really a management problem, we are more interested in seeing whether we see any striking differences in the career status of women on the parameters already discussed. What kind of organisation has offered a better status?

We examine in this section differences between public and private sectors, differences between large size and small size units and differences between the four types of scientific establishments such as those that are teaching, or doing research, or engaged in production or in service-oriented units.

The variables covered are: posts (i.e., the position held by the respondent in the job-hierarchy operative within that establishment), salary levels, promotion prospects, chances for exercising leadership, working conditions, opportunities for inservice training, attitude of male colleagues and discrimination. For discrimination, indirect questions were also asked on actual instances where, though they were eligible, a male was chosen.

The findings are supplemented by observations from other studies on the organisational features of scientific establishments in India and their bearing on the question of what barriers women face in working in such establishments.

### **(i) Posts and Salary**

In teaching, while the private colleges had only two women at senior level, the majority of the women are bunched at the lower end. If we turn to researchers, the public sector is not much better than the private sector. In both, most of them are at junior level or middle level. In administration, in the public sector, the proportion of women in our sample who were at the lowest end was twice as high as in the private sector. In the technical category, salary and job levels were better in the private sector (see Table 2.17).

Salary levels and posts do not coincide between the public and private sector. For many categories of posts (except in teach-

ing in private colleges) salary levels in the private sector were higher.

### (ii) Effect of Size of Unit

Salary wise, the small unit in public sector had more teachers at middle level, but in the private sector, there was not a single woman in the higher brackets. In research establishments, women were doing better in the public sector and slightly better in the smaller units for certain categories but overall bigger units were better. We did not have any public unit in the industrial establishments included here but here too, the smaller units were better. In the service category, the private sector and small units were better.

If we could make an overall assessment for post and salary together, the public sector was better and the bigger units within it presented a more advantageous picture. Within the private sector, the same relative status with respect to size can be seen — the bigger units offered better terms. Perhaps the bigger units in both the public and private sector had more standardised norms.

### (iii) Promotion and Other Prospects

The public sector was distinctly superior in promotion possibilities, but in the actual realisation of it, except in research, in other establishments the private sector was better (Table 2.18).

**Table 2.18**  
**PROMOTION PROSPECTS BY SECTOR AND TYPE OF ESTABLISHMENT**

	<i>Number</i>	<i>Not possible</i>	<i>None so far</i>	<i>Many years ago</i>	<i>Few years ago</i>	<i>Total %</i>
<i>Teaching</i>						
Public	23	35.0	30.1	4.3	30.6	100.0
Private	97	60.0	14.4	2.1	23.5	100.0
<i>Research</i>						
Public	118	9.3	28.8	13.5	48.4	100.0
Private	6	16.6	50.0	—	33.4	100.0
<i>Industry</i>						
Public	—	—	—	—	—	—
Private	65	41.5	15.4	4.6	39.5	166.0
<i>Service</i>						
Public	67	46.3	26.9	7.5	19.3	100.0
Private	24	70.8	12.5	—	6.7	114.0
<b>Total</b>	<b>400</b>					

#### **(iv) Working Conditions**

As for working conditions in general, 304 women (about three-fourths of the group) rated their working conditions as satisfactory in all types of establishments. Of the remaining 96 women, 85 were "partly" satisfied. Once again the public sector was rated as more satisfying. Secondly, there were more women who found the smaller units unsatisfactory. Contrary to the general impression of the "indifferent" public sector for women employees it appeared in this case to offer a more congenial work place. There was greater protection available due to standardised norms on the one hand, and on the other, there was less direct supervision and control over time and work output. The channels for redressal of grievances appeared to be fewer in the private sector. However, teachers felt their job status was less than their qualifications and to some extent this was true of the women in research. This was understandable as they were usually more highly qualified but their pay scales relative to other sectors was usually poorer.

#### **(v) Training Opportunities**

Only 19% women received training with assistance from their organisation and research organisations appeared to give more help.

Scope for initiative in job according to the respondents was greater in smaller units and in the public sector generally. Recognition in terms of promotions, inclusion in decision-making and awards were low in all establishments but out of what was available, the public sector came through as more supportive. Those in teaching and research felt their education and experience was directly utilised but those in industry and lower level service category felt it was not. The difference surprisingly between the public sector and private sector was that the public sector was seen as better. Participation in professional organisation was higher for teachers than for other categories. (Seetharamu's (1981) finding that women in general do not participate adequately in union activities holds good for this sample also, with the exception of teachers).

What can we say about the career prospects and work place conditions as between different establishments? Overall women in research organisations were more satisfied, found their work stimulating. However, women in industry who were in higher positions or those who received better salaries were happy with

the emoluments and benefits but did not have much involvement with their work. In all sectors, the bigger units were found to be preferable and in general, the public sector turned out to be a better place for women.

There were 25 out of 400 in whose opinion organisational obstacles existed. The "top" management was sympathetic but a good many women reported on the unfavourable attitude of male colleagues. Many male colleagues were reported as resentful that women "took away men's jobs". Women were seen as not needing jobs and as not serious about their work inspite of the fact that many married and unmarried women supported their family's level of living: there were a few cases where the women had taken up jobs to secure a regular income till their husbands got launched in their private practice (law and medicine). This negative attitude of male colleagues was reported more from private industry. In the public sector it was less openly expressed.

17 women were emphatic about the prevalence of discrimination. They quoted instances of promotions withheld or other facilities given to men rather than their competent women peers. This included instruments for research, nomination for training or conferences, not being selected for committees etc. However, in private conversation, the women who attempted to assert their rights were seen as trouble makers and they felt alienated from the other women as well as other male colleagues.

### **Findings of Indepth Interviews on Discrimination**

In the detailed indepth interviews with 30 women, 15 of whom held senior posts in different establishments and 15 of whom were at the bottom, more frank and open statements were available. Of the fifteen women who could be said to have done reasonably well vis-a-vis the rest of the group (though all of them may not be equal in status to men in their establishments) it is significant that more than half pointed to discrimination against women. Two women, one, a senior programmer in Electronics Software Consultancy and another, a senior physicist, were both categorical that they were bypassed for promotion though they both deserved it on the basis of seniority as well as merit. Two women who held executive posts in big pharmaceutical firms said that often while management was appreciative of merit, immediate supervisors and male colleagues generally resented women's presence and regarded women as inferior. The general feeling

among male colleagues particularly in companies seemed to be that women did not need jobs as they were supported by husbands or that they wasted time decorating themselves and were not serious about their work. A fact noted by all the fifteen high achievers was the absence of women in policy making positions but the reactions of the women were different. Some accepted it; a few felt they could not cope with extra responsibility but three or four who were outstanding in their field felt this was unfair and that women deserved a better deal. A professor of microbiology in a medical college pointed out that in her department, women faculty outnumbered men and yet the head of the department was always a man. In another case, a professor in botany in a private college said that so long as one pandered to male ego, one had less problems. "Men never accepted women as equals. Though I am head of the Botany Department and a man is the head of the Zoology Department, he is the administrative head of both departments". She added ruefully, "I could not afford the time anyway".

There were at least six women among the high achievers who felt that apart from straightforward discrimination, women faced problems at work because the work place made no concessions to the fact that they had other duties to the family while men did not. A pharmacist described how the work allocation between shifts was often unfavourable to women. In her company, capsule weighing requires great accuracy and women are good at it but men get this job because they work in both shifts while women can legally work in only one shift. A biochemist in a research organisation lamented that she could not continue experiments at all hours as a man could because she had to get back home to attend to her family. A college professor who was about to retire said "It is impossible for women to achieve professional competence the way many of us would like to unless there is a great deal of support from the family and the organisation".

Four women (a research scientist, a pharmacist and two college teachers) on the other hand seemed to think that there was not much discrimination and if only girls were more serious about their work they would do well. Yet, one of them, despite publishing over 40 papers and having had twenty five years' experience never rose to the top. She was only the head of a small section.

Amongst those women who were at the bottom, such as stenographers, lower or upper division clerks, junior technical or research assistants, laboratory technicians, there was no sense of an unfair deal. Most of them were B.Sc.s. though there were a couple of M.Sc.s. among the laboratory technicians. Among three college demonstrators in private colleges, the opinion was that the college managements were equally unfair to men and women but one demonstrator went further and reiterated that in addition, women did get less than fair treatment despite the number of women students and women faculty being sizeable. She was in fact planning to get a women's lobby going in the college. A research assistant who was very active and enthusiastic about her work also complained of discrimination while being sent to attend seminars and to serve on committees. Besides this the supervisor insisted on co-authorship in all the papers published by her. (This could be true of a junior male researcher as well as in his relation to his supervisor).

What these interviews seemed to bring out is that discrimination is sensed and resented by women *when they wish to achieve* and when they are sure they are putting in their best. Those with a certain amount of drive experience obstacles but those who are "satisfied" with whatever opportunities they have, do not acknowledge any "discrimination" despite objective evidence, in one case, of missed promotions. To the lower rank employees, the nature of the job is such that no achievement is possible as in more intellectually demanding jobs and as such these women are not seen as threats by their male colleagues. To many of the women in this category the primary motive for the job was either economic need or to be doing "something".

Unless we have a great deal of inside information and obtain meticulous records of the career history of all the men and women in an establishment it would be impossible to "prove" discrimination but multivariate analysis of labour market such as those done by Becker (1964) or Tilak, (1980) where education, experience are held constant, there is a residual of inequality which cannot be explained on the basis of differences in quality.

## I

Some issues emerge from the phenomena described in this section: (a) where there is a declared, official policy, regarding recruitment of women, treatment is more equitable; (b) in those jobs traditionally associated with intellectual achievement and

where women are accepted, women have a more conducive environment; (c) private establishments (especially in industry) are reluctant to offer women equal opportunities at higher levels, particularly for policy making; (d) treatment of women is influenced by the group-syndrome. Each individual woman, however different, is perceived as exhibiting the group characteristics. We saw that many women here did not have domestic responsibilities of such a degree or nature as to seriously interfere with their work — actual hurdles or obstacles affected only a few of them. The majority had support-systems at home which gave them the chance to put in their best. When we talk of work commitment, in this group at any rate, one does not see any evidence that they are neglecting their work or they are working less hard. What they are at present unwilling to do is to push for equality because of (a) lower expectations; (b) a more integrated view of their total life commitments of which the paid job is one, though a very important part for most of them.

Can we identify those aspects of the organisational structure which inhibit their progress? From our study here we cannot generalise on the nature of the scientific establishment as such. We have here a variety of functional categories. The need for extra involvement or longer hours of work apply to the serious research scientist to a greater extent than to other categories of jobs.

Chakravorthy's (1984) analysis of the R & D establishments give us some clues but these need further probing. What are the ingredients that make teaching usually more accommodative to women? Some of these are known — fewer hours, vacations, less interaction with males and so on but we cannot explain why within teaching, women are in *lower* positions? These definitely relate to hiring practices and norms where temporary posts are created: they also have some connection with the higher turnover in teaching — it is a job easy to join again. In industry, it seems to be a matter of outright discrimination. In order to establish the degree of discrimination and the degree of inequality of opportunities, one must really examine and see whether all cases of promotion were based on merit criteria. Our hunch is, it is unlikely to be so. Cole's (1979) hypothesis that by and large the scientific enterprise is a meritocracy does not hold good in India, where the shortage of jobs puts a premium on holding on to what one has got and where the scope for manipulations is greater. In research however where recognition has to be based on published work, there is more of the merit criteria operating but even

here, there is not as yet a well established Indian scientific community that can judge the quality of the published work; by and large our standard of reference lies outside the country, which again raises the point of visibility. Visibility does influence the opportunities available for research and publications in the form of funds, resources, contacts. *The visibility of women scientists tends to be lower.*

The structural obstacles which we can squarely place at the doorsteps of the organisations can only be *guessed* at, at the moment because the veneer of legal equality clouds those *invisible* stumbling blocks that women face.

### **The Scientific Community**

Some observations on the "scientific community" as a whole would be pertinent here to place the question of women's position in perspective. We have seen the relative status of women in different types of organisations and saw the difficulty of drawing generalisations from categories of women whose work ranged from professor to demonstrator; from research scientist to laboratory assistant; from managerial cadre to clerk. Even if we talked *only* of our research scientists the scientific organisation in India does not at all times encourage merit. However, among many people the impression persists that what is necessary is a certain "attitude" among scientists for the growth of science.

Back in 1895, Ingram (1895) declared that "laboratories, lectures and degrees are nothing if they do not reflect or encourage the true scientific spirit which is above emolument or show. If we can prepare for it (science) a proper, congenial atmosphere, if we can rise to the right level of research, understanding the magnitude and dignity of the task before us and resolving to yield a sacred devotion to truth at all costs then it will surely not be long before this spirit find in our midst".

Firstly, science is no longer an isolated activity but is a social movement, interacting openly at various social, economic, political, organisational levels (Bernal 1969).

Secondly, the professionalisation of science, with fixed hours, with a salaried person has made a qualitative change wherein heroic differences are not possible and recognition gets limited in general. The diversification of scientific activity has meant a greater reliance on others e.g., on documentalists, on



travel, on contacts etc. It means the channels for success are other than mere "merit".

Thirdly, the conversion of the scientists into a salariat has reduced their autonomy and some would even call them the R & D proletariat (Sabato 1975). The appropriation of technology which is effected by those who own the means of production or by those who control them (private firms and government) ensures that its final use shall be decided without any reference to those who manufacture it. The scientists are therefore as alienated from the process as ordinary workers and clerical staff from current production. Others claim that scientists are less alienated than artists because they work within established paradigms and enjoy prestige, (Hagda 1982) but this treats the scientist as an autonomous individual worker.

Fourthly, it has been accepted that the large scale formal organisation of science is now the standard pattern. The centre of gravity has shifted from university to government sponsored research. The typical work situation is different from the popular notion of scientist. By excluding this significant phenomenon, Ellis (1972) feels historians and sociologists have failed to interpret social reality of science as it operates. By defining science as pure research, they assume away many of the complexities of scientific enterprise today and hark back to old academic values of passion for truth etc.

If these are features of scientific organisation all over the world the Indian set-up has even more flaws. The scientist in India is not the most prestigious nor the most highly paid according to a CSIR study (Rahman Bhargava *et. al* 1973).

**Table 2.19**  
**PER CENT OF PROFESSIONALS IN CATEGORIES**

<i>Salary level per month</i>	<i>National scientist</i>	<i>Engineer</i>	<i>Medical doctor</i>	<i>Civil servant</i>
Rs. 1500-2000	2.2	2.9	1.5	15.6
Rs. 7200	1.0	3.0	2.0	15.1

In analysing the modes of participation of Indian scientists, (in special areas of research) it was found that Indian scientists lacked confidence, were isolated from their own peers and that the "successful" ones were those tuned into foreign peers and that the leading figures in science and science policy in India

were out of touch with Indian scientists, having no direct personal contacts with them (Shiva-Bandopadhyaya 1980).

Our study also accepts the argument that lack of commitment is *not* the problem but the mode of organisation of science-work.

“Since large parts of the criteria of scientific choice cannot be explicitly applied or applied in isolation of scientists from each other, the existence of a scientific community which shares scientific criteria and values becomes essential for self-sustaining scientific activity in a particular society. While the scientific professional in India is the third largest, it does not constitute a scientific community” (Rahman, Bhargava *et. al.* 1973). The stagnant and marginal character of Indian science makes Indian scientists aware that very little of their research is important in world science and that it does not have any particular use in Indian society.

Doing science requires active participation in conversations of an informal sort with fellow scientists, reading journals, attending seminars, publishing papers, reports etc. From this most of our scientists are largely excluded.

It has also been pointed out that whatever exists in the name of a reward system is extremely faulty here. There are too many strata, too much authoritarianism, stoicism, favouritism, inadequate procedures for assessment etc.

Visalakshi, Qureshi, Gupta (1983) allege that while we have adopted the value system of the West, we have not evolved objective criteria. They also found that awards went to sectors where more prizes were instituted (medicine/agriculture) and to those who were affiliated with prestigious institutions. Those who achieved recognition through awards also got greater recognition by institutions and more facilities were put at their disposal. In other words, success gets more resources.

### **Features of Science as a Profession**

Science is primarily seen as a source of knowledge, as that part of society that “produces” new information. Storer (1966) describes the patterns of interactions between scientists wherein professional recognition is the motive force that stimulates creativity, not an unattached pursuit of knowledge for the sake of knowledge.

The picture of scientific activity as disinterested pursuit of truth is a highly idealised one. According to this view science has certain universal characteristics which set it apart from other activities, a certain ethos. These are: (a) universalism i.e., the physical laws of the universe are the same, no matter who or what is involved, (b) organised scepticism i.e., no knowledge or previous research result is to be taken as final and valid and criticisms are voiced in public, (c) every scientist must share his/her findings, (d) a scientist must display disinterestedness i.e., he or she should not profit in any personal way, be career minded or have any illicit personal motive.

Such a picture is a highly romanticised one anywhere but it fits India even less. Here the majority of scientists are not lone explorers but work as government employees. The composition of the professional scientist is again hard to define. Ideally, the "scientist" is an individual who spends most of his or her working day in basic research or related activities, gathering information, reporting findings, evaluating the work of other scientists and so forth.

He/she is directly engaged in the attempt to extend our generalised knowledge of some aspect of the empirical universe. Research professors in universities or other research institutions supported by government or industry to do basic research; research scholars supported by fellowships, teachers who spend some time in research; others doing applied research in industry, government etc. These according to Storer are the "core" of the scientific community. Beyond them lie teachers who only teach, applied researchers, administrators of scientific establishments, technicians, students. Where we draw the line depends on our purpose. If the exclusive concern is to study scientific output or creativity then one would concentrate on the "core" only. In our study we have included all categories that are included in the practice of scientific activity. The "reward" system then is not the same.

Even if we focus exclusively on the core-scientists whose only goal is production of new scientific knowledge – does the "meritocracy" really apply? Disagreeing with other authors (e.g. Barber etc.) he shows how the reward system actually works. To regard science as belonging to some pure realm outside society is an invalid abstraction anyway. If we accept however that scientific community operates on the principle of rewarding merit

there are snags because the process of *awarding* recognition is a social process, and is itself part of a social system. The basic motive that spurs creative activity in a scientist is "recognition" by the profession, not some abstract things such as the value of his work to humanity or addition to knowledge etc. It is *recognition* which he/she exchanges for working on inadequate material and other rewards. It is this concern to *continue* to receive competent response to one's own creative efforts that underlies the basic pattern of behaviour comprising the social structure of science. One's work has to be approved by the scientific community, their judgement is important. It is therefore not enough if one adheres to the so called *norms* of scientific behaviour.

The manner in which recognition accrues to an individual scientist is not problem free. First professional recognition is not merely a competent response from others but is also a means of acquiring influence in the professional community and therefore the recognition sought is *public* response in the form of public awards, citations etc. This has connections with the type of relationships one has with one's colleagues. One gains authority due to *past* performance. The egalitarian ethos is only an ideal; in reality there is a hierarchy within the community. Those who have acquired authority through *past* recognition wield considerable influence on who can be given recognition.

Similarly, every scientist is supposed to follow the norm of organised scepticism and yet when one is asked to evaluate other people's work, the evaluation is not usually strictly *honest* – it is couched in polite language and considerably muted in tone because there is also the need to maintain social ties with others in the profession. The third norm of "commonality" i.e., sharing one's work is rarely followed because there is a keen desire to be the *first* to publish the finding.

Lastly, the absence of career - mindedness as the norm for the scientist in reality, is not free from social pressures. When doing further research (or future creativity) or to keep the "recognition" on a continuous basis, jostling for influence, access to resources, prestigious connections etc. are inevitable. Scientific activity is therefore not a rarified activity unsullied by human and social motivations.

If the reward system is itself flawed, even in countries where there is a greater tradition of objective evaluation, it is even more flawed in the social and economic context of a Third World

country. The so called "ethos" does not obtain to the same degree not because Third World people are particularly deficient in this virtue or because of Asian/authoritarian culture. A shortage economy with an already existing hierarchical tradition compounds the situation.

Women caught in this trap suffer from a double handicap — first because the system is flawed to begin with; second, as women they have even less "authority" with which to obtain recognition. If the system is not impartial to male scientists, it is even less likely to be egalitarian to women, who are new entrants and who already have a subordinate position in society in other ways. It becomes then easier to avoid giving recognition to new contenders.

The perception of individual success by a few women confining as it does to their individual success, fails to see the flaws in the structure. In a situation where very few women achieve distinction, their own record, they see as flowing from great personal merit and the failure of others as due to those others not being able to fulfil the norms. They fail to see that: (a) not all who do fulfil the norms get through the barriers, (b) not many are in a position to fulfil those norms in the first place and their own success in this respect could be partly due to advantageous circumstances (family support, domestic help, good connection etc.) and only partly due to their own abilities. The belief in the impartiality of the system conceals the structural chinks:

### **Is Science Itself Male Structured?**

There is another dimension to the analysis of defective structuring of science. This goes beyond saying it is lopsided capitalist development. It argues that science is not merely a product of capitalism, it is also patriarchal; not merely in the sense of giving unequal opportunities to women or because of sexual division of labour but because the theoretical or intellectual framework of science is masculine.

One strand of this criticism is that science has a male-stereotype (Weinreich 1979). The scientist is presumed to have a certain life style and personality traits appropriate to male rules. This can explain why male colleagues may not behave favourably with women scientists. The fact is that there are women who are successful. How do we quantify negative attitudes into "discrimination"? In a study of 150 undergraduates where they were asked to rate disciplines as hard/soft, mas-

culine/feminine, abstract/concrete, the correlations with masculine indicated science as hard, complex, intellectual etc. These dimensions are *evocative*, not evaluative. Is there such a thing as feminine knowledge? Lots of girls do mathematics, for instance. What is needed, according to this approach, is to de-sex knowledge. Studies on successful women scientists show them to be intelligent, serious minded, independent, dominant, self-sufficient and emotionally stable. These are all characteristics similar to successful scientists. At present, data does not allow us to separate what factors account for success from what factors help women to *enter* science.

For elite scientists (called Apollo scientists) it was found characteristics associated with traditional masculinity (listed above) were useful, but masculine ways of thinking, the cognitive style and the handling of emotion as inappropriate. Success in a competitive world requires some qualities, (which are *seen* as masculine) but creativity comes from non-masculine ways of thinking (Intuition).

It is doubtful if these "stereotypes" really hold good in India where segregation is not masked by any devious device and "knowledge" theories are also different.

A major and a very radical criticism is that science as it has developed reflects androcentric bias in choice and definition of problems. Many areas necessary for women are not taken up for study. (Hubbard *et. al.* 1979). Secondly, some would go further and say the design and interpretation of experiments is influenced by male bias. (Recent examples have come from paleontology and primatology). The answers to these would be that fair minded scientists should help in identifying such biases and make science more objective and rigorous.

The most far reaching critique of science is not with imperfect applications which can be corrected once biases are detected, but with the *ideology* of science itself. What really are the assumptions basic to science, of rationality and objectivity?

As long as the course of scientific thought was judged to be exclusively determined by its own logical and empirical necessities, there was no place for any signature, male or otherwise in that system of knowledge. In that case gender differences come not from science but because males exclude females from that activity. But today there is much greater appreciation that scientific

knowledge is shaped by particular social and political contexts. At the same time, Keller (1982) argues that one should avoid the extreme reductionism of regarding science as nothing more than a social product; then science dissolves into pure ideology and objectivity loses all meaning.

To reject "objectivity" altogether as male would be a grave error. The problem really is: (a) to distinguish that which is parochial from that which is universal in the scientific impulse, reclaiming for women what has historically been denied to them, and (b) to legitimate those elements of scientific culture that have been denied precisely because they are defined as female.

The implications of joining objectivity with masculinity are less well understood. This conjunction serves *political* functions. This is now increasingly identified with the psychic process of gender identity creation in society. It is stated that psychological and cultural pressures lead all three ideals affective, gender and cognitive to a mutually reinforcing process of exaggeration and rigidification, so that science gets reflected as an objectivist ideology (male) and female subjectivity is devalued.

Keller is dissatisfied with this explanation. She feels this leaves out the psychological meanings of power and domination. She raises a fundamental issue: Are control and domination essential ingredients of competence and hence intrinsic to selfhood (because attaining selfhood is defined as attaining autonomy and autonomy requires competence) or are they correlates of an alienated selfhood (because autonomy rejects dependence, affiliation)?

The psychic process of male gendering beings with a shift from competence to power and domination, in order to repudiate sameness with mother and to compensate for feelings of loneliness.

Similarly, under what circumstances can scientific knowledge be sought for the pleasures of knowing, for the increased competence it grants us, for increased mastery over our fate and under what circumstances is it fair to say that science seeks to **dominate** nature? Is aggressive manipulation of nature the result of phallism?

Knowledge in general and scientific knowledge in particular has a twin aspect. Of mastery over and union with nature; so is sexuality – of mastery over the other and ecstatic communion.

Keller concludes that the excessive emphasis on power and control in the rhetoric of science is a projection of a specifically *male* consciousness. She quotes many instances from the language used by well known scientists in the West. She also points out that the dialectic between aggression and transcendence is rejected in preferred methodologies, preferred theories. As an example she quotes the victory of the Master-Molecule concept in cellular biology. There was the controversy on whether the organisation of cells was on the basis of a controlling centre (nucleus) or complex-functionally interacting self-perpetuating organism and the proponents of hierarchy have won.

These are all very profound and fundamental issues on the methods and theories of science and scientists as well as their theoretical orientations but we have as yet very little work done in this area.

To Indians the problem becomes even more compounded. If Indian philosophical orientation to knowledge and knowledge seeking activities – the relationship envisaged between nature and man – are different, then the implantation of a different ideology would make for serious disorientations. It is hard (despite Keller's admirable efforts) to disentangle patriarchal bases (psychic phallism) from competitive capitalism that sets store by domination over nature to increase accumulation and consumerism. Do women really have a more nurturing role towards nature because of their gender role as some feminists argue? If the ideal of development even in socialist societies is that of increasing production by "domination" over nature, is this alien to feminine styles? If one looks at the way animal experiments are conducted how would one reconcile them with a belief in the sanctity of life? Therefore, one can argue that the contradictions in the scientific endeavour come from both patriarchy and capitalism.

We further noted that the structure of science in its organisational patterns, discourage women's *full* and equal participation. Whether, given equal access and equal opportunity within the scientific hierarchy, patriarchal cognitive structures would still remain are speculative questions. It requires both equal power for women as well as rising feminist consciousness to resolve that. That these issues are beginning to be raised in India is a healthy sign (Prakash 1984).



## Conclusion

We saw that in India, there are differences as between organisations. The public sector and larger units are somewhat better employers. The small unit in the private sector offers the least advantage.

The responses of the women to questions of discrimination appear to be connected to the *type of work* they do. Among research scientists, where publications and recognition as a scientist are crucial for success, women face hurdles because the life styles of scientists and their work are male-structured wherein women's family responsibilities come in the way of those "extra hours" outside one's work hours that can make a difference. In addition, practices and type of activities that increase visibility are less accessible to women. The scientific system *as a social system* is less than ideal. The scientific enterprise, according to feminist critiques also suffers from a built-in bias towards aggressive competition both due to capitalism and patriarchy. Women's inadequate access to science as of now reduce their chances of uncovering such biases. In India, feminist critique of science, not merely in the sense of not being able to get adequate rewards but of the *methodology* of science itself has not begun to be articulated. While they share in the shortcomings of science-organisation in India with men, as women they appear to have *additional* obstacles.

## II

In addition to the question of whether science educated women are doing well in science establishments, we are also interested in finding out to what extent it has generated a scientific outlook. How do they see the value of science to society and to themselves?

So far the mechanism of progressive change has been conceived of as involving a non-contentious process of acculturation, diffusion and trickle down of the benefits of growth (Inkeles and Smith 1974). The connection between development and cultural change are ambiguous and often spurious westernisation goes side by side with other indicators of development (Dube 1977).

Science developed within a specific set of historical factors in Western Europe along with capitalism. In pre-capitalist societies there is less advanced division of labour, less specialisation and functional specificity. Can diffusion of science take place in

Indian Societies that is undergoing the process of change towards capitalism?

Science operates as a source of cognitive authority in the modern world with its repository of theories, findings, procedures, techniques which it generally makes available both directly via expert intervention and consultation and indirectly via its interaction with technology and with specialised institutions in the economic and political structure. Not only does science provide knowledge and competence, it is also required to evaluate the knowledge claims and putative competencies of those situated beyond its boundaries. Everything must stand the test of science in a truly modern society. Anyone who would be widely believed and trusted as an interpreter of phenomena needs a licence from the scientific community. There is a prior faith in this super-cognitive authority of science. To be "scientific" implies that scientific judgements are protected from other contaminating influences (one's personal prejudices, personal goals etc.) The barrier that protects scientific valuation, judgement etc. from other things is believed to be a rational commitment to scientific method. The advanced countries portray this image of science as the most credible source of knowledge by virtue of which science has acquired its glamour and prestige.

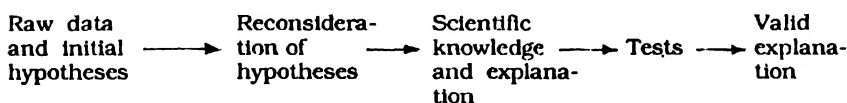
In the developing countries, science in its instrumental value has much more immediate relevance. They are attempting to transform their society through science and technology. There are three dimensions to the spread of science as a social movement: (a) practical application or the acquisition of fruits of science, (b) spread of scientific knowledge, (c) acceptance of a scientific outlook. We are here concerned with (c).

### **How do We Define a Scientific Outlook?**

Traditionalism implies attitudes and values that give pre-eminence to authority and custom in the modulation of behaviour. It makes for stability and continuity of tradition. By the same token, it can also resist forces of change and adaptation. Rationality or scientific temper does not subscribe to any absolute truths based on authority but would accept as valid only those things for which evidences have been collected scrupulously. It has no place then for simplistic *a priori* assumptions, or superstitions, beliefs and prejudices (Newman 1962, Singh 1973-74, Holton 1958).

The common sense notion of science as "discovery" or revelation is not how the scientist himself regards his activity. Nature can be patterned in different ways. No particular ordering is intrinsically preferable to others. Specific orderings are constructed, not revealed, with attention to experience. Though science operates within a set of conventions, specific to the approach, the merit of scientific activity or approach lies in this that the scientist lays out scrupulously the presuppositions of his subject — in other words science proceeds on explicitly formulated criteria, and hence they are verifiable by others. A community impregnated with science is one in which recognised experts have arrived at their opinion through scientific methods (Frank 1954, Russell 1954, Cornelius 1970). Truth in science is not a dogma but the inescapable condition for its practice. The scientific outlook is an ethic derived from its own practice (Bronowski 1965).

What is distinctive about the scientific method is what is built into it, namely the possibility of disproof. It is an adaptive, integrative, negative feedback process where inputs are new data and new hypotheses as to what the underlying theories might be. If experience and expectations differ, either the body of scientific knowledge or the input hypotheses or the data are refined and adjusted until observation and prediction can be brought back into agreement (Sparker 1981).



We are not positing a kind of polarity between science and tradition in the study but change and development can take place only if there is a willingness to examine previously held beliefs. Scientific knowledge does not postulate unconditional truths but truth-hypotheses valid for a range of specified conditions.

This above discussion summarises the major points of agreement among a number of scholars who have attempted to explain the basic characteristic of a scientific outlook (Oppenheimer 1958, Bridgeman 1958, Conant 1952).

We quote from the document on scientific temper and accept this as the concept we have discussed above.\*

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\* "A Statement on Scientific Temper", released on July 19, 1981 at Nehru Centre by nearly twenty scholars and scientists.

"Scientific temper involves the acceptance of the following propositions: (a) that the method of science provides a viable method of acquiring knowledge, (b) that human problems can be understood and solved in terms of the knowledge gained through the application of the method of science, (c) that the fullest use of the method of science in every day life and in every aspect of human endeavour – from ethics to politics and economics – is essential for ensuring human survival and progress, (d) that one should accept knowledge gained through the application of the method of science as the closest approximation to truth at that time and question what is incompatible with such knowledge."

It is not therefore unrealistic to assume that exposure to science would generate some degree of a scientific outlook and that scientific outlook involves a rational appraisal of previous beliefs and practices and a willingness to discard such beliefs/practices that are inconsistent with scientific knowledge.

Do our science educated women, daily in touch with scientific activity, carry science beyond the laboratory and the class room? If they have not or imbibed it partially what could be the reasons for it?

In order to study the approach of these science educated women to science and how they see the relationship of science to their everyday life at home, and to specifically isolate the impact of science one would require carefully controlled groups but what we are attempting to see here is something much more limited. We have some opinion statements on how they see the usefulness of science and how they rate the scientist's profession. Lastly, do they have a scientific outlook? Apart from participating in employment did their science education give them other benefits? We try to see how far they practiced their knowledge in those areas of family life wherein they were most intimately involved such as food preparation and child care. We asked them not only whether they practiced or refrained from practicing certain customs, traditions normally observed by women but also their reasons for observing them. This could tell us indirectly whether they examined these beliefs and traditions and what kind of rationalisations they took resort to. Were there any signs of conflict experienced in rejecting or preserving traditional modes of behaviour?

The customs we have chosen are arbitrary and selective and are based on our common sense idea of what are normally prac-

ticed in an Indian home. The indicators are few, and not exhaustive as it was not possible to explore a whole range of behaviours pertinent to this area of inquiry within the scope of this study. It would require more sophisticated and elaborate methodological devices. In any case, even with statistically validated attitude scales construct validity is always a problem. Our exploration in this area is of a tentative nature and we do not seek to make any authoritative pronouncements on the basis of the responses we received. In general, the responses in this section were not very good; many questions were not answered in full (or were left unanswered by 20-30 women).

We also examined the women's approach to science by finding out how they saw the usefulness of science and how they rated themselves as a profession. To the majority, the instrumental value of science was more appealing but one third did give first importance to scientific outlook as the outcome of exposure to science. The medical doctor was held in the highest esteem by most. The research scientist however gave equal importance to the "scientist".

A proportion of women in our sample do have a strong sense of the prestige of their profession and display self-esteem on that count.

### **Usefulness of Science**

The questions were open ended and the range of responses is indicated in Table 2.20.

Practical uses was seen as the most important value of science, followed by scientific attitude as a second most important reason and the latter as a value is much more pronounced among the M.Sc.s. than among others.

### **Reasons for Choice of Science**

Why did they go in for science? They had chosen science out of interest, say 88.3% of the women. To the remaining, it was the greater job potential or the fact that it did not involve too much reading. Some 3.0% admitted they were influenced in their choice by their peers.

### **Rating of a Scientist**

Science is regarded as a high prestige profession. Did these women then rate it highest among professions? To a sizable number of women the doctor came first, followed by the scientist. (The

**Table 2.20**  
**USEFULNESS OF SCIENCE**

(Number of Women  
(% in brackets))

<i>Level of education of women</i>	<i>Gives better jobs</i>	<i>Has practical uses</i>	<i>Helps in personality development</i>	<i>Develops a scientific attitude</i>	<i>Not useful</i>	<i>Total no. of women</i>
B.Sc. and other qualifica- tions	19 (10.0)	101 (53.1)	10 (5.3)	55 (29.0)	5 (2.6)	190 (100.0)
M.Sc. and other qualifica- tion	17 (9.5)	89 (49.5)	1 (0.5)	71 (39.4)	2 (1.1)	180 (100.0)
Ph.D.	4 (13.3.)	16 (53.4)	1 (3.3)	8 (26.7)	1 (3.3)	30 (100.0)
Total	40 (10.0)	206 (51.5)	12 (3.0)	134 (33.5)	8 (2.0)	400 (100.0)

doctor is perhaps seen as saving lives). An Engineer comes only third and a teacher comes at the bottom. Other choices were businessmen, government officers, journalists etc. but hardly 18 women rated the scientists as the highest.

More women from the service establishments rated the scientist as the highest, but to others the doctor came first. Teachers holding higher levels posts did not show any marked preference but the higher level research scientists did hold the scientist in high esteem. Among technicians and administrators, it is the women who were in lower posts that rated the scientist higher than others. It may not be valid to read too much into these differences, but that researchers had a higher esteem for the scientist than teachers is significant. More prestige attaches to the research scientist who can gain recognition and professional status through his or her work but there is no comparable public recognition for good teaching. The few teachers who gain recognition are those who have research and publications to their credit. Among research scientists there may be a greater sense of their own status as they are much more in contact with scientists or their work from abroad and in contact with other prestigious establishments within India both of which lend an air of importance to their own work.

### **Perception of National Priority for Science**

We had earlier seen that the practical uses of science was what they valued most. When asked specifically to rank three uses of science to which the nation should give weightage – science for creating a scientific outlook, for knowledge and for improving production, we had additional confirmation that science was seen by the group primarily in its instrumental aspect.

Only 26.5% of the women gave scientific outlook as the first priority. To over half the group science should be used primarily for increasing production.

### **Rituals and Practice of Science at Home**

Among the customs that were chosen to see whether women observed them and the reasons they adduce for so doing or not doing were: observance of fasts; keeping vows to cure illness; consulting horoscopes and observing taboos associated with menstruation.

We had chosen these few practices which are especially observed by women and which are reflective of beliefs that are unscientific as well as derogatory to women and ensure their subordination or perpetuate the "gendering" process that creates identifications with their roles in the family. About 45% of the group do not observe fasts; of those that do observe fasts, the reason given was religious. Many fasts observed by Hindu women are to ensure the welfare of husbands. As for horoscopes, only 33% consulted them for marriage or in crisis situations; 30% of the women did undertake vows to cure illness of children or other family members. 43% did not observe any kind of menstrual taboos; others did in varying degrees, most of them refraining from worship. These observances were stronger among Hindus and Jains.

These practices were also chosen because in each case, a special role and perception of women in society is involved and modern knowledge and modern science has provided better explanations for phenomena thereby reducing these practices to acts of faith, belief or superstition without any basis. Astrological predictions are based on the notion that planetary movements determine the destiny of human beings. Current knowledge in astronomy, in biology and social sciences have made this assertion less tenable. Illness in modern medicine can be clearly related to physical, **natural causes** where intervention for cure has to be based on a thorough understanding of the physiology and

chemistry of the body, the precise pattern, sequence, effects of different diseases and their causative mechanisms. The observance of vows to Gods would in the light of this knowledge, where such knowledge is available, be irrational though there may be cases of faith cure for organic and chronic diseases or psychosomatic diseases. Fasts in Hindu religion play an important role as acts of self-denial in order to obtain special favours from gods. Usually women's fasts are undertaken in order to ensure the welfare of husbands/children. They are propitiatory acts to induce the gods to bestow special favours, to remove impediments. A rational outlook would imply the renunciation of such beliefs when many rational explanations exist for the outcome of many human actions. Menstrual taboos evolved out of a fear of blood and inadequate understanding of the reproductive cycle in human females.

In the light of current scientific knowledge on this natural phenomena, the retention of these taboos would imply the persistence of irrational prejudices and superstitions. To what extent do these women who are exposed to science and therefore presumably are aware of scientific facts and scientific explanations not only practice or not practice these observances and rituals but examine them? Do they sense any discrepancy between their knowledge and their behaviour. Even though they may practise them, if this discrepancy is felt, to that extent is there an acknowledgement that they are not behaving rationally?

The implications are far more to them as women than to them as "scientists" because many rituals are also symbolic of women's subordination and are also mechanisms for perpetuating it. Many of the fasts have the in-built value of the husband as the superior, whose life needs safeguarding; that a woman without a husband is inauspicious and therefore women must by penance continually redeem and safeguard their "auspicious" state. While men may also fast or keep vows they do not have the same obligatory nature. Most of all, in menstrual taboos, the idea that women are unclean is perpetuated. Childbirth and menstruation are considered polluting states. Women as a consequence have to suffer both symbolic and actual indignities.

Had it been only a question of symbolic subordination, such practices may be condoned as the innocuous display of male supremacy but for the fact that such beliefs based on ignorance



often lead to harmful effects. The practice of seclusion is also accompanied by inadequate opportunity for proper hygiene during menstruation. Ignorance of the reproductive system among humans, the causes for infertility, the process of sex determination etc. lead to blaming the woman as the sole culprit for barrenness or for not producing a male progeny and she is victimised accordingly.

Science in our minds should act as a liberating agent, liberating one from ignorance and reducing one's gullibility to beliefs and superstitions which have no rational foundation. A science trained woman could examine practices which are irrational and also examine rationally her own status. This latter point is outside the scope of this limited study.

The reasons given for observing fasts ranged from frank admission by 154 women that it was part of religion or tradition or they believed in it (55 women explained their observing them by some rationalisation that it was "good" for health, that it improves one's control over senses or that it gives a chance to introduce variety in one's diet etc.

The reasons given for their behaviour by those who did not observe *any* fasts were primarily that they did not believe in them and did not think them necessary in any way. Only 29 women said they could not observe fasts because it did not suit their health or that they had no time for them.

While fasting was associated with religious traditions, horoscopes were perceived clearly as superstition. Those who consulted horoscopes (33.5%), in the majority of cases, did so at the time of marriage and when they had some personal problems. A few dabbled in it, out of curiosity.

Those who did not keep any vows were a very significant proportion (58.3%) and they said categorically that illness can only be cured by medicine and not by such practices. The women who kept vows said that they did it because it gave them psychological support when their husband, child or other relatives fell ill. Only 11.0% did so as a matter of implicit belief in its efficacy.

### **Observance of Taboos during Menstruation**

In India, certain customary restrictions are placed on women during menstruation such as not mixing with others, not entering the kitchen, not taking part in religious activities etc.

The 42.7% women who have discarded totally all the taboos treat the phenomenon as a natural bodily event requiring no ritualistic response. Out of those who do follow the custom either partially or fully it is because they were brought up that way and associate it with their religion; some 35 women follow them merely out of deference to elders who insist on it. Surprisingly 25 women despite their science education believed that women were impure during these days and 5 women rationalised these practices saying they were good for women's health.

There were differences by age and educational level to some extent. The younger women and those with M.Sc.s. were more progressive. Family upbringing came out as a more decisive factor.

There is obviously *some* imbibing of 'science' knowledge. A proportion of those who saw the importance of scientific outlook, were also consistent in their behaviour and rejected many of the customs mentioned above. To those who did adhere to the customs, it was a kind of compartmentalisation and fear of losing one's cultural identity.

### **Differences in Behaviour as Between Different Groups**

We notice the practices most clearly seen as superstition have been more easily given up whereas those perceived as enjoined by religion are less easily given up. That menstrual taboos have a much stronger hold than others and has implications for women's status, it is evidence of the deep rooted systems of control over women, one of which is the notion of impurity – birth, menstruation and death are impure states. The notion of purity and pollution is thought to be integral to Hindu culture. We tried to see differences as between the different religious communities in the observance of the above rituals and customs. Christians do not observe fasts while Jains and Muslims do so more often. Horoscopes are resorted to mainly by Hindus. Vows are kept more by Christians, Jains. Menstrual taboos are observed to some extent with respect to worship by all but the taboos are strongest for Hindus and Jains.

Differences by educational level were not uniform. It varied according to the custom. For observing taboos during menstruation or consulting horoscopes, the educational level made some difference but in the case of others, it did not.

Bhagwan Prasad's (1968) study of 100 families in five big towns is relevant as a comparative measure with men. The study had a section on religious beliefs and superstitions. 90% had faith in God, 70% went to temples and did daily worship; 41 to 51% believed in palmistry and astrology but only 9% believed in black magic and other superstitions. As his survey covered men, we have a basis for comparison. Our women do not appear any more "traditional" than the men.

The younger women appear to be distinctly less traditional. Though we have clubbed together all persons who observe restrictions of some sort or the other, many of them, observe only partially and the most widely practiced restriction is only that of refraining from worship.

Marital status is less important than age, because the unmarried were also by and large, younger women.

However, an important difference emerged as between women who had science trained family members and others who did not. The women coming from a science family background were less traditional; the degree of departure from tradition varied for different customs. It was higher for horoscopes and menstrual taboos but the difference was less for fasts and vows. Many had asserted in an earlier section of our questionnaire that scientific outlook should be given top priority. Did their own behaviour tally with their statements? We compared these two set of responses. We did not find any close correspondence except for "keeping vows". Behaviour and opinion statements do not necessarily tally.

### **Family Role and Mother's Role**

To what extent did the science educated women "apply" their scientific knowledge to the care of health, nutrition and child care? The majority of women did not make any special attempts to plan meals to ensure proper nutrition. Of those who did not plan, the reasons were diverse — 8.5% had no responsibility, 3.5% had no time; 15.5% did not think it was necessary and 1% wanted to but they faced resistance from elders in the family.

They were asked to state what kind of habits they thought promoted good health of children. Cleanliness, regular feeding times were mentioned by all and in bad habits they included using pacifiers, irregular, unhygienic feeding, tight clothing etc. Fifteen women condemned the practice of leaving small children

to the care of servants. Most of them believed that proper sex education should be given but felt schools should do it.

In general they disapproved of punishment as a form of disciplining children and the use of threats or frightening children. Only 14% leaned towards authoritarian measures and felt children should obey but the majority preferred gentler, persuasive tactics to convince children of their errors.

### **Promoting Science Mindedness**

These highly educated women gave importance to science education for their children but the methods mentioned under-stressed creativity, inventiveness, curiosity and emphasized buying them more books, making them study regularly etc. – In other words through more information (Table 2.21)

**Table 2.21**  
**METHODS OF PROMOTING SCIENCE MINDEDNESS AMONG CHILDREN**  
**MENTIONED BY THE WOMEN**

No special attempt	107
Through scientific games	54
Through books	54
Through experiments	50
Through media programmes	11
Demonstrate value of science in every day life	47
Show interesting things in nature	22
Help in science study	7
Provoke curiosity	18
Stimulate by questioning	10

These answers were again tallied with their earlier rating of scientific outlook. An important difference was that among those women who gave highest priority to scientific outlook, experiments, demonstrations, curiosity found more frequent mention, while those who had stressed the instrumental value of science had emphasized information giving to a greater extent. There is to this extent a value - consistency in the responses.

### **Family Environment**

The most important influence in shaping the women's behaviour appeared to be family environment. In-depth interviews with thirty women revealed that this was more important than the level of education. The family atmosphere as being progressive in outlook and the lack of rigidity in their approach were mentioned by those who believed strongly in scientific outlook.

Women who had limited approach to science or were conventional had parents who had emphasized the job prospects of education or its economic value, while women who were more open, less traditional, had been motivated in education as an important value in itself.

We noticed a definite moving away from tradition but the change is partial. Much greater changes are observed in health, hygiene, child care practices than in others. Limitations of a sample study preclude any generalisation. We cannot isolate the impact of science by eliminating powerful co-acting forces such as general education and urbanisation. Earlier studies (Rahman 1973, Jatsurya 1970, Mehta 1970) on male scientists also came up with the finding that they stick to many conventions and tend to keep their work-life separate from their life at home. The cultural complex of modern science seems to have developed unique and adaptive idioms. They accept the ethos of science as an intellectual stance — they subscribe to its tenets of objectivity, critical review etc. but with regard to various cultural aspects they seem to accept the traditions of their culture; participate in rituals, accept the authoritarian structure of family norms and believe in and abide by caste sanctions and norms. Primordial loyalties were important and desire for security and stability was dominant. Rama Mehta in her study (her data refers to 50's) found that Hindu women followed caste injunctions only partially; for example isolation during menstruation was not followed but cooking and worship was not allowed.

With regard to education, the parents in her study were of the opinion that education must not become a threat to family "harmony" but Mehta noticed that educated women had gained confidence in themselves.

Many of them, according to Mehta, had grown up without enough acquaintance with Hindu rituals, lacked not only knowledge but also lacked any special feeling towards them. At the same time they were conscious of this serious lack, and celebrated festivals and attempted to *formally* adhere to some practices and customs. On giving up rituals many felt deprived of their identity as Hindus and this robbed them of meaning in life. There were two subgroups — modern educated but tradition — oriented and the other group more western-oriented, placing higher importance to personal fulfilment. The latter were not afraid of disapproval and were self-reliant.

We find too a progressive sub-group similar in orientation; among the larger group the same ambivalence to customs was seen, the same fear of losing identity.

Vimal Mehta's (1979) sample of 900 women teachers examined a number of issues: family, social, cultural life, education, women, jobs, and politics on a scale of traditional/non-traditional conservative/progressive continuum – their attitudes to women's free movement in society, to purdah, caste, religious rites, traditional customs, etc. According to her study, women respondents coming from very progressive families had a progressive outlook and the level of education of the respondent by itself was not a decisive factor but the most interesting finding was that she found the *science group more progressive than arts*. Mehta says that the impact of science on the respondents led them towards radical and progressive attitudes. They developed a more scientific attitude towards life and its problems than the arts group, that proved to be more traditional and conservative. Other significant findings that closely tally with our own data are: (a) the younger group was more progressive, (b) the most decisive factor was family background, (c) those who were less religious were more progressive. She detected a desire to identify with the culture as a broad trend; marriage was perceived as necessary for emotional security and job was required for economic security. We see among the middle-classes distinct trends (though not strong enough yet) of new orientations to marriage, employment and tradition.

Rekha Sharan (1982) also claims that many changes such as in allocation of power, decisionmaking, decline in rigidity of caste and a trend towards individual "achievement" are noticeable in her study of employed women in industries and services.

Raj Mohini Sethi (1976) and Rhoda Blumberg (1980) in their studies also confirm the sense of ambivalence educated women have over many issues. But we do not agree with the categorisation that free choice marriage is modern and adherence to arranged marriage is unmodern. Many institutional pre-requisites that can support free choice marriages have not emerged in India. Caste based identities are very strong and while this persists endogamous marriages would be necessary. As Satish Saberwal (1985) points out, India has historically been a pluralistic society; caste units had their own practices, norms without reference to

any overall agreed universal ethic as evolved in Europe through centralised states and the Church.

There are special historical cultural factors that can explain some of these contradictions (Barnes 1972). We notice the kind of adaptation that takes place. The human actor adopts a way of life largely determined by her/his culture and the positions she/he occupies within it. Most of those elements which are crucial to the acquisition of further belief will be found empirically to have been received in the socialisation process. The actor with a given system of concepts and beliefs is influenced by her/his experience of the world into adopting new beliefs or new concepts. In the long-run, some beliefs persist as stable features of a culture, as institutions, whereas others are progressively modified or eliminated. Yogendra Singh's (1973) earlier studies also emphasize the process of compartmentalisation.

In conclusion one might say that these science educated women have moved away somewhat from tradition but there is partial adherence to many customs perhaps for fear of losing identity. There is a greater practice of scientific knowledge in child care. Some superstitions have been given up by many but taboos that have a religious sanction are less easily given up. Younger women are more progressive, though the educational level is not such a decisive factor as that of family background. All in all, many of these women turned out to be conscious of their science training and the importance of science especially in relation to children, though even here certain inhibitions persist and they tend to view science more in its instrumental aspect than as promoting rationality. The exception is a strong minority group who are predominantly in research who hold the cultivation of scientific outlook as a priority. Disappointingly, there is no decisive impact with regard to the value of science in examining their own status as for example in the practice of customs that reinforce the subordinate status of women.

At the level of imbibing a scientific outlook, while the way science has developed in India with its elitist bias and colonial precedents, has prevented the true emergence of a science-imbued society, for women once again their role in the family imposes special constraints in loosening them from rituals that are linked to their place in the family – the caste norms and the image of women in Indian society derived from patriarchal structures.

**Table 2.22**  
**LEVEL OF POST HELD IN ALL ESTABLISHMENTS**

	Teaching			Research			Technical			Administrative		
	Pub- lic	Priv- ate		Pub- lic	Priv- ate	Joint	Pub- lic	Priv- ate	Joint	Pub- lic	Priv- ate	Joint
Profs- sor/Head	—	1	Fellow	4	—	—	Div. Officer	—	1	Upper Management	0	—
Professor	—	3	Officer Level Sr.	7	2	0	Syst. Analyst etc.	4	9	1	—	—
Asst/Assoc. Prof.	5	—	Middle level	42	5	1	Middle level	24	24	1	2	—
Reader	—	—	Junior level	20	4	—	Lab. Tech. etc.	26	12	—	7	17
Lecturer	10	12	Res. Assts.	37	—	2	—	—	—	—	—	—
Demonstra- tor/Tutor*	3	81	—	—	—	—	—	—	—	—	—	—
Total 115	18 + 97	134 —	115 + 16 + 3	102 —	54 + 46 + 2	47 —	LDC/UDC/ Steno	12	5	1	21 + 25 + 1	—

\*At the time of the survey the post of tutor/demonstrator was prevalent and was abolished later on.



To this second theme, we now turn.

What is irrationality? It implies inconsistency in rule following or indifference to experience and argument whereas it *might* mean merely that another authority source than that of the scientific consensus may be accepted. Belief in simple, highly general tests for truth lead to stress being laid on the role of "rationality" but if we become aware that there are esoteric presuppositions that underlie scientific evaluations, then it would be more meaningful to take scientific disciplines as accepted knowledge sources. Following on this, the questions we have been grappling with can be reframed: what factors contribute or detract from their effectiveness as a knowledge source? To put it simply, rather than frame the problem as a confrontation between rationality and irrationality it would be more legitimate to think of science as an accepted knowledge source, its basic premises being very esoteric and unintelligible to lay persons (e.g. one need not go into the highly abstract formulations of physics to justify some common applications of the laws of physics, such as, say "gravity"). If science is an accepted knowledge source, then the question to ask is what factors inhibit its diffusion? The success with which science can operate as a general knowledge source for people depends on three characteristics: (a) knowledge sources are most effective when they present an image of unanimity and certainty; scientific disciplines lack institutionalised mechanisms for mobilising and maintaining a consensus to present to an outside audience, (b) actors oriented to a scientific discipline as a knowledge source cannot perceive its internal boundaries of competence and allocation of status. This may strengthen the external influence of views discredited within science, (c) strong internal consensus achieved by scientific disciplines and essential to them, is maintained by a stringent narrowing and purification of agreed goals within them.

These conditions prevent an *easy* transition merely through a rough and ready rule of thumb, "scientific method". The articulation between science and society can come only through a long drawn out social change. It requires a number of intermediate and mediating roles between the two. This helps us understand why science education *per se* may not result in transference of this knowledge unless other conditions are present.

Firstly, the existence of scientific knowledge does not guarantee its diffusion. Secondly, even those who teach and learn science deal with limited areas of relevance. Most people see science as a self-justifying intellectual study or as a means of national progress (Ziman 1981). The success of science has meant that those who needed science bought them and pure scientists were left in the universities or research establishments to advance knowledge and they were preoccupied with the job of teaching the young to *do* science. Consequently scientific establishments see no reason to educate science students *about* society. Without this critical understanding of society the mere learning of science in colleges becomes more a matter of learning a new category of "skills" without altering the perceptions regarding society. Barnabas (1976) says the same thing and illustrates the gap between the natural scientist and social scientist.

"Natural science courses relate only to the study of principles — factual information, formulae, calculations. It has performed very poorly the function of communicating the spirit of these sciences, of creating a scientific temper of mind, which is able to relate the mode of thinking to one's own everyday life". Scientific ideas, concepts, modes of thought become remote from those a student has imbibed through her/his tradition.

One could argue that insufficient application of scientific knowledge by science educated women spring from the manner of teaching natural sciences which make them far removed from social problems and the contents of everyday life.

It can also be interpreted as a general transferability problem. Essential to higher order (Welford 1980) non-manual skills are various mental capacities for giving meaning to both instantaneous situations and sequences of events, in extrapolating knowledge gained in one context to others.

These propositions regarding the difficulty of diffusion of scientific knowledge are broadly true but to understand what particular aspects are absorbed and what are not, one has to analyse the specific historical-cultural circumstances. Defining "modernisation" as awareness of possibilities and the capacity to choose, instead of in terms of popular notions such as that of modern means, recent or western or industrialisation, Smith (1965) stresses the power of ideology. What people choose (even status quo is a choice), how they choose is determined by what they think is worthwhile. What people cling to may be not just "ir-

rational" habits of thought but perception of uncertainty as a threat. The performance of rituals, adherence to customs gives one a sense of identification with one's caste. Hinduism particularly creates problems; much of the everyday practice of Hinduism lies in its rituals and customs which if surrendered can give one a feeling of vacuum.

In general, changes are never smooth. A change in cultural patterns of behaviour involves a change of systems. No one system is entirely irreducible to another (Znaniecki 1940). A proof of the irreducibility of earlier culture to later culture in any field is the fact that many old cultural patterns survive the material destruction of old cultural products and continue to be used, though less widely, along with modern patterns; evidently the solution of certain cultural problems which they give is still satisfactory to many people. This is true of science. Many people believe that progress in science consists of dropping out invalid things and incorporating what was valid. No system of knowledge is entirely reducible in its theoretic bearing to any other system, however superior the latter may be in its capacity to solve many and various problems.

The implication of this is that dropping out "invalid" beliefs is not an easy matter of merely *knowing* that an alternate or superior or more valid knowledge exists. To be incorporated, it requires a change of systems; a change in several other social determinants. In this case, what are needed are both rising consciousness of women and changes in their role in the family and society.

The directions of scientific inquiry, the priorities chosen, the uses to which scientific knowledge are put are all shaped by social factors. Because the instrumental aspects of science are directly perceived they are more easily absorbed. To use a pressure cooker one does not really need to know the principle on which it is constructed. The tie-up between science and technology and the social system appears to lie, not so much in the nature of science in its ideational aspect as a particular system of knowledge as some of the authors have tended to emphasize (*viz.* its esoteric nature etc.) but much more in the mode of relationship established between the scientific enterprise and the social system. This link is clearly visible in the Third World countries. In all these countries science and technology have been introduced without any restructuring of the social system. Long-term goals

of development will be met only when there is diffusion of power, knowledge, or rewards in the widest possible degree. Historically, scientific development itself was concentrated around particular poles. This polarisation prevented proper integration.

In the advanced countries there is greater diffusion of scientific knowledge due to spread of education and mass media and science in addition has become a subsystem interacting with the consumer society. There, the very concepts and principles of science developed not only for their technical value but social value; scientific thought developed in particular ways related to its possible functioning in the general social context than the esoteric scientific context. Science as expertise developed also as part of the process of social differentiation. The modern highly differentiated societies rely on specialised knowledge and competencies and have also evolved special roles and institutions associated with them. In the absence of these other structures the diffusion becomes subject to whether the scientific knowledge in question attacks or supports effectively social institutions. Darwinian theory or modern physics get reinterpreted within the metaphysical framework of Hindu philosophy but menstrual taboos remain! The latter are linked to a deep rooted social structure where women are "impure".

According to Rahman (1973) in the West, there was separation between science and religion. In India, the aim of knowledge was placed within the context of religion. Therefore, though considerable knowledge was available in diverse fields, no laws of nature to systematise knowledge in a conceptual and theoretical framework could be developed. Since the laws of nature were not clearly developed no conflicts could arise. New information, new interpretations could in the absence of a theory coexist with older/other information. The serious challenge to science and conflict with it came not from theories of nature but from social attitudes and practices. As science did not go through the process of social interaction which it did in the West, Indian scientists developed an ambivalent attitude to science and its relation with philosophic and social values. Hence no commitment to science as a broad intellectual movement developed. Conflicts arose only when social practices were challenged. The central role of scientific outlook lies in the extension of the scientific method to social problems, application of values generated by science to problems of everyday life.

There are other explanations on how the historic context of science in India dilute its diffusion. Science is still an isolated activity. Its organisation is restricted in scope, character and structure. On the other hand, a macro change in systems such as adult suffrage has been easily accepted and has made a tremendous impact on our political processes. The history of science is not merely that it was introduced from a context which was outside the cultural-economic-social system but the manner of its introduction meant a break from the indigenous scientific tradition which was largely in Sanskrit. Our education system incorporates knowledge and skills which are relevant to Western societies; secondly, the very physical isolation of educational institutions makes it a subculture. Education in our economy even now (unless it is at a very high level) provides no immediate functional relevance to most of our people.

How does all this bear upon our question of the value that women have derived from science education? We saw that they were more prone to accepting and applying scientific knowledge in certain areas of life than in others — such as those practices that improved health of the family. Those customs that had connections with religion and gender relations were not shaken off so easily. Science education has by and large enhanced the worth of the Indian woman in her traditional role as a mother and the family-keeper rather than help her to challenge her subordination.

The educated woman faces a contradictory position. Her education is derived from her status as belonging to upper castes and higher classes. Secondly, the condition for giving her education is that she keeps the family harmony, retains its traditions, be a cultural watchdog etc. To throw out traditions then is to threaten the basis of the support she receives from the family for her education and career. Hence her ambivalence; hence the selective absorption of some scientific knowledge. Again in a situation where only a small proportion of women are highly educated, breakaway behaviour sets one as a deviant. Thus, urbanisation which confers anonymity and loosening of family control creates conditions more favourable to rejection of unwanted traditional customs than science education by itself. The picture is not too gloomy. We saw that there are trends towards new ways of behaving and evaluating — the younger women are more "open".

To conclude, while much of our analysis has been to demonstrate the hold of patriarchy and the influence of capitalist development, stirrings are visible, in the minority of women even in our sample who are beginning to question their inequality and in the growth of individualism with advancing capitalism. There is also among the younger generation, a minority who are rejecting rituals and getting less religious and more rational towards social custom. These are faint whiffs in the wind, that sound hope for the future.

### **Summary and Conclusions**

This study examined women scientists, their work and families. Scientists here referred to science educated women working in science-establishments. Therefore, it covered different categories of workers. The sample for the survey was drawn from Bombay and in order to see the effect organisations had, they were stratified by function, ownership and size. Four types of establishments were covered; teaching, research, industry and service-oriented establishments. Two major issues were the (a) benefits of science to women, (b) the impediments faced in realising them. The influences identified were that of the family and society.

For Indian women, with the growth of the middle-classes, development of higher education and the reforms that loosened earlier control over upper caste women due to the new demands of the socio-economic system, opportunities for education and employment emerged but these were muted within the fundamental structure of patriarchy. The social relations of production interact with social relations of "reproduction" and the latter are as class specific as the former. How women perceive themselves or society perceives them are derived from these structural postulates. Role explanations are inadequate because they refer to normative expectations only without an analysis of the material base of patriarchy whose core components are control of women's labour and sexuality.

The study examined the following areas: the social background of the group; the preparation made for a career in science, their career status on a number of objective and subjective indicators, the influence of the family, and the influence of the organisation.

The majority of our science educated women hailed from fairly well-educated Hindu families, who were comfortably off

owned flats or had decent accommodation. Besides this, they also came from families with a science background, by and large. Religion made a difference in so far as Muslim women came from families with a lower educational level while Parsis had the most highly educated families. The group had a large proportion below 35 years of age and two-thirds were married women. There was only a sprinkling of divorced and widowed women. The married woman had well educated husbands holding equal or higher jobs in the same or related professions. The married women had on an average, two or three children only. These findings corroborated the general features of the middle-class educated urban women. Also, that they have tended to marry into families with a somewhat lower educational level compared with findings from other studies. Education for women in India is linked to their class status.

The graduates (B.Sc. level) were 44% of the sample, of whom about 4% had also acquired additional diplomas or degrees such as B.Ed. or B.Lib. The proportion of post-graduates was higher, being 56% of whom 7% had doctorates. A few among the M.Sc.s. had also acquired a degree or diploma on B.Ed. or B.Lib. or medical technology. Judging from the year of their first degrees the women appear to have entered after the 1960's and were also predominantly Bombay-based. More than 75% had no special training or experience before they took up jobs and except 20% who had superior academic performance, the others had done moderately well. Disciplinewise, the concentration was chemistry and biology with a small number in physics and mathematics. These women had a strong desire to use their education and had made efforts to get jobs, had made plans to take up a career though their plans were not specific.

The career profile of the group gives a mixed picture but on the whole the rewards accrued are less than their qualification. There were 14% who did purely administrative work but the others were doing either teaching, research or technical work related to science. Among teachers, 73% were at the lowest level posts while among research scientists, the majority were at middle level; in the technical cadre, they were mostly at the bottom with a few at the top, with no one at the middle level and in administration, they were at clerical level barring a couple of women at the officer level. The mean salary of the group was around Rs. 1000-1500 p.m. (at the time of the survey.)

Years of experience made only a small difference in salary for teachers; the research scientists improved moderately. While the improvement was best in industry, it was worst for those in administration. More than 61% had not received any promotion and most of them had little opportunity for exercising initiative or leadership. Nevertheless, 70% expressed job satisfaction. This seems puzzling unless we interpret the response in the light of what they are really seeking. Most of them had job security, had opportunities for work but apparently they were not pushing for equality or advancement. Most of them had also admitted that recognition for their work was either nil or limited to only praise and hardly ever concretised in promotions or awards. There was a distinct minority (about 7.5%) who were very dissatisfied and these were mostly research scientists. Publications from technical workers and administrators were few and as was to be expected, research scientists published more, followed by teachers. Even among those who did publish, only a few had done very well. Marriage did not make any difference but educational level did, with M.Sc.s. doing far better than others. However, the women had not participated in any collective struggle or activity, in unions or even in professional bodies.

It is often surmised that women do not get better prospects because they do not have an unbroken career. This was not true of the majority; only 10% had breaks but they were older women. Most women did not perceive any need for special organisations of women to promote women's needs. The only deeply felt need by 20% was for child care facilities.

Interpretation of their moderate success and the lack of any perturbation over it hinges on what we mean by career motive. It is alleged that women have a "lower" career motive either because of commitment to families or their conditioning which makes them less militant. While there is some truth in this we argue that the difficulties are structural and not individual motivation. The structural impediment is the role of patriarchy which operates at both the place of work and the family. Their domestic labour at home is obligatory. At the place of work they are seen as supplementary earners or as being "supported" by earning men and hence their career rewards are not necessary. Women's domestic labour lowers the value of their labour power because they bear the cost of their own reproduction through their production of use values at home. A man on the other hand under capitalism is paid wages to cover the cost of his reproduction. Hence arises the



unequal position of women in the labour market despite equality guarantees. These guarantees in the case of professional women can only ensure equality at the point of entry but not their subsequent progress.

The ways in which the labour process structures the organisation of work within a particular mode of production is influenced also by the relationship between the sexual division of labour and the labour process. In scientific establishments, the way work is organised, the way rewards are given presume a male labour force. While availability of kin and servants release women for work, it does not release them totally for pursuing a career.

In examining the family set-up and the organisational bottlenecks, we find these above conditions to hold good. There is considerable encouragement for education in science, particularly by fathers and no discrimination against daughters for time needed or facilities needed. It is significant that the one important discrimination was that daughters were expected to help in housework but sons were not. There were four women in the group of 400 who experienced discrimination as daughters in many ways including support for education. It is clear that "decision to work" is no longer a problem area for educated women. We tried to see whether there was preference for conventional jobs but we found family support for employment in all categories under our study. Perhaps because they are all "white-collar" jobs, there is not much difference.

What kind of concrete assistance did the family members give to these employed women? By and large, many of them depended on relatives and servants. A small group who had no available relatives had problems with child care. Husband's support seemed to be more in not demanding special attention rather than in sharing work. Even here there were a few who complained that they or the children were "neglected". In other words it was their wives' obligation, not theirs. Less support was available from husbands who were in the same professions and there appeared to be a competitive striving to be better than the wife.

Whether marriage and children were impediments depended therefore, on the arrangements available. 30 women had to forego chances for betterment, 18 women had to change jobs and 60 women could not put in extra hours for research or other activities that would have given them recognition.

There were other indicators that demonstrated the persistence of patriarchy. Very few women kept any part of their income for their own needs. In examining the family background more closely during the indepth interviews of 15 high achievers and 15 low achievers, we found that there were two groups among the high achievers — one group whose families had stressed intellectual development and another where work as a means of getting a higher standard of living was stressed and education had a more instrumental value. The majority among the low achievers were those who could not qualify further, needed to earn and had to choose jobs that were easy.

The effect of different organisations on the career prospects showed that the public sector and large size units were better employers, may be because they have fairly standardised norms and labour is more organised. Among teachers, private colleges offered the worst terms with less job security and scarcely any upward mobility. In research establishments, there was not much difference between public and private sectors for in both the women were in middle level posts. For those in administration, the private sector paid more but post-wise it was difficult to distinguish between the two. The public sector had more promotion possibilities but fewer actual promotions. The least satisfactory working conditions were in the small units in the private sector. One can deduce from this that, *it helps women to have legally enforced standard norms, where there is less chance for direct discrimination.* Among the women who did complain of discrimination the majority were in research and in executive positions in private industry. They gave instances of how they were bypassed even though they deserved promotion both on the basis of seniority as well as merit.

Among the obstacles that many mentioned were the attitude of male colleagues who often made statements such as, "women do not need jobs" or "women are not serious about their work". To research scientists and teachers, the extra time needed for publishing, for attending seminars, or taking on other responsibilities, staying back after office for laboratory experiments is difficult for they have obligations at home. Other studies also show that for those women who are able and willing to do these, opportunities are not always given. Men manage to corner activities that ensure high visibility. The organisational obstacles therefore are not merely those of size or ownership but also the patriarchal elements in the scientific establishments themselves.

In India a true scientific community has not evolved yet and therefore rewards for "merit" do not always follow but for women there is the additional handicap of gender hierarchy in society.

### **Implications and Issues**

The country has since 1958 made a serious commitment to the promotion of science and technology. In the last thirty years we have increased the number of our training institutions. We have today over 140 universities, nearly 2000 affiliated colleges, 5 institutes of technology, 150 engineering colleges. Overall we boast of over 900 research institutions in the country as a whole. Our stock of scientific and technical manpower has been growing at the rate of 9% per annum, and we spend about 0.63% of our GNP.

Yet, how well is this enormous potential human resource utilised? As the Sixth Five Year Plan (1980) chapter on science and technology puts it, the benefits of this enormous enterprise has not actually accrued to the people. "Science and technology should be deliberately planned and purposefully directed towards the fulfilment of national goals by enmeshing science and technology planning in economic plans. No less important is a change in the attitudes, value systems, content and quality of the training of scientists and of the academic community in general".

The revised Plan 1980-85 acknowledges that science and technology must contribute to the improvement of life and status of women and to their greater involvement at all levels, especially at higher levels. To this end, it recommends more science teaching for girls and new personnel policies that will enable women to look after their families and continue in employment.

### **Improving Employment Status of Women**

We had assessed the career status of women and found that the gains were modest. Differences arose as between the public sector and private sector. As the survey covered different groups, teachers, researchers, technicians and lower or middle level administrative personnel, the problems and responses were different. Research scientists emerged as more progressive, more rational and also more dissatisfied with the unequal opportunities both for more creative work and involvement and also with discrimination. For teachers, the problem was temporary appointments and stagnation. Overall, women in science shared the unequal employment status of female labour in general, when taken as a group. For this, we hypothesized structural and

objective conditions as causative factors rather than low career ambitions of women. The latter is only a way of coping with a situation. In view of the institutional inequality in the structure of occupations and sexual division of labour can one really expect more than minor changes in working conditions? Many see part-time employment as a solution. It would only give official sanction to women's part-involvement in spheres outside the home. Self-employment is another panacea offered. With mobility restrictions operating on women, inadequate access to resources of every kind (market/credit) etc. this is often a non-solution.

The Planning Commission had set up a Working Group in 1981 to evolve personnel policies for bringing greater involvement of women in science and technology.

Some of the recommendation made were:

- (1) Conscious effort should be made to remove bias against women and to ensure that there is no covert discrimination against them and that they are not bypassed when opportunities for professional growth and vertical mobility became available.
- (2) Personnel departments should prepare a compilation of all government orders and rules including facilities available and decisions of government on matters of personnel policies.
- (3) Husband and wife should be posted at the same place.\*

"The problem should be seen from the point of view of facilitating combining of both the job and family responsibilities and not either one of them".

(Here the document presumes that this "home" responsibility would be that of women).

- (4) Requests for various kinds of leave may be granted sympathetically.
- (5) Distinctions between temporary, permanent, quasi permanent cadre regarding leave facilities should be removed.

As an afterthought, the document adds:

- (6) There should be support services for child care.
- (7) Government should encourage the marketing of pre-processed foods so that women can save on cooking time.

\* Will this be possible if they are in different occupations, sectors?

- (8) When women withdraw from profession to take care of family responsibilities, help should be given to help them return to their profession.
- (9) There should be flexible hours of work.

Finally, it stressed the need to ensure that women who take up careers in science and technological fields are able to move up the profession.

Women's Welfare and Development Bureau in the Ministry of Social Welfare should take up monitoring and evaluation of the implementation of personnel policies and other measures recommended in this report.

The thrust of the recommendations are based on the fundamental premise that women may be wonderful scientists but they have a primary responsibility for home and family. Therefore let us modify the severity of the penalty in joining a profession by reducing that burden.

The first problem that arises is that, no doubt, assuming that these measures can be implemented they will be beneficial, but to what extent are they steps towards liberation? We are not saying nothing should be done for women. Child care facility is the major requirement. There are still problems. When special facilities are given to women because of their special role, within a competitive market economy this often leads to non-employment of women. So long as the costs of reproduction are borne by the individual family and especially the women through their unpaid labour, it is not worth the while of employers to employ women under terms where these costs have to be taken over by employers. In a situation of mass unemployment, men may be preferred because they are *less* costly. It requires a tremendous commitment on the part of the State to provide such welfare services. In a situation where such expenditures are subject to political pressures, they are usually pruned down in a tight economic situation. These are questions of implementation which are connected to the level of economic development. We have very progressive labour laws but can they be reasonably implemented where millions do not have work? When the State does not guarantee work, how can it guarantee proper working conditions?

At the second remove, without some watchdog committees with full powers, how will the recommendations be effective?

These are immediate solutions, but some fundamental handicaps will remain if our problems are seen as not helping women to play a "larger role" in addition to domestic role but a question of quality. There is considerable misunderstanding on this issue. Equality is mistakenly interpreted as "being like men". The problem has been that sexual segregation and sexual division in family and in occupation (and in society as such) has carried hierarchy-implications. Gender relations are not merely "different but equal" in nature. Data abundantly proves that women are *denied* access and control of crucial resources of society. Power to formulate policies, power to disburse funds, power to implement policies, these are real, objective components of life. The greatest contribution of the growth of science is the way it is making sexual segregation unnecessary. Physical differences account for less and less in the matter of modern production methods. Contraception releases women from excessive childbearing. But these are potential aids in liberation, their concrete effects will depend on who controls them and for what purpose.

The remote question of what is science for and for whom its benefits should go are also issued that conjoin with women's liberation. Do we want equal participation in a nuclear holocaust?

We see the essential ingredients in a strategy for women's full and equal participation of women in science as:

- (1) Evolving collective struggles in styles suitable to women and geared to their real needs and problems.
- (2) Identification with problems of women with other classes.

Would women scientists be content with a 50:50 ratio for their own classes, whose very participation depends on availability of domestic service at cheap rates from other dispossessed women?

- (3) Seeking a resolution of both class and gender inequality.
- (4) Identifying phallic, patriarchal sources of distortion that prevent human development and healthy growth of science in non-domination styles.

The agenda is both development of consciousness for men and women, and collective struggle by women. In the case of scientific establishments, they could begin by having their own

cells for monitoring progress and demanding affirmative type action by government.

It is often argued that individualistic careerism on the part of women is harmful for women and children and family harmony. Why is it thought less harmful for men? The future of our children, their healthy growth in a healthier nonalienating social arrangement is the business of all of us. Feminists are saying, for too long have women paid a price. Is the price necessary or is the price worth it, if the results are no more congenial in the ultimate interests of all of us?

Further research is needed in a number of areas.

- (1) Science as a male-stereotypical activity may not be appropriate in India; does science really have a male image? Because it is new, this may not hold good here.
- (2) Comparative data for different categories of scientific workers, male and female needed.
- (3) More detailed information on the job specification of each category of work.
- (4) More details and analysis of the precise domestic/other burdens of women; family relationships.
- (5) Documenting the historical contributions of women to science.
- (6) More details on women awardees (prizes, scholarships, awards) and contributions after independence.

These may give us a clearer picture of the nature of problems both for women and generally in the way science is conducted in this country.

Our present study suggests the range of problems in this area.

The class and gender aspects of the situation of women in science in its historical contours need to be kept in mind and much greater indepth research into women's history is needed.

The growth of the middle-class in India under colonial pressures led to opening up of educational opportunities for women but the position of women was still contained within patriarchal structures. This is reflected in the ambivalent position of educated women; their employment in the modern day has loosened some patriarchal fetters but retained the essential ones. Thus while capitalism loosened feudal fetters for the upper castes,

gender relations moulded by a transformed patriarchy continues to operate for women, within the home and outside. At home, the sexual division of labour and caste norms in marriage and control of women within the family continue. At the place of work, while the scientific establishment in India does not operate on a merit-system as it is supposed to, for women there is a further inequality introduced by gender, with punitive consequences for their career-rewards. The bases for this inequality are firstly the sexual division of labour which prevents full involvement by women in their career and secondly by the way work is organised within scientific establishments which is male-oriented.



**Appendix**  
**FULL LIST OF ESTABLISHMENT COVERED BY THE SURVEY**  
**TEACHING**  
**Private Sector**

Sr. No.	Universities/Institutions/ Colleges	Total Academic Staff	Women with Science
1.	University of Bombay (Depts. covered in the survey)	99	9
2.	VJTI	160	7
3.	Catering College	45	4
4.	Institute of Technology (IIT, Powai)	1470 (Academic + Administration)	15
5.	Institute of Population Studies	17	5
<i>Colleges</i>			
6.	Elphinstone	97	7
7.	Wilson	83	17
8.	Institute of Science	75	16

Total No. of Establishments 8.

Total No. of Women 80.

**TEACHING**  
**Private Sector**

Sl. No.	Colleges	Total Academic Staff	No. of Women Science Degree Holders
1.	St. Xaviers	100	14
2.	Rula	103	23
3.	Sophia	52	13
4.	Jaihind	72	11
5.	Bhavan's	89	10
6.	National (Bandra)	52	10
7.	Ruparel	73	17
8.	K.C. College	79	21
9.	Kirti College	72	8
10.	Parle College	80	17
11.	S.I.E.S.	99	7
12.	Mithibai	85	28
13.	Dayanand	68	9
14.	Jhaveri	62	13
15.	Jhunjhunwala	69	20
16.	Patkar	58	4
17.	Maharashtra	52	6
18.	Somaiyya	64	23
19.	Nirmala Niketan	20	4
20.	S.V.T. College of Home Science	61	7
21.	Sardar Patel Engineering	69	2
22.	Hazarimal Somanl	81	6

Total No. of Establishments 22.

Total No. of Women 273.

**RESEARCH INSTITUTIONS**

Sl. No.	Public	Total Staff (All categories)	Women with Science
<i>Fundamental Research</i>			
1.	B.A.R.C.	10,531	242
2.	T.I.F.R.	1,600	35
3.	Tata Medical Centre	800	18
4.	I.R.R.	186	23
5.	C.R.I.	276	25
6.	Haffkine	1,175	53
7.	Blood Group Reference Centre	8	3
8.	Institute of Geo Magnetism	100	10
9.	Institute of Naval Medicine	27	5
Total No. of Women			414
<i>Others</i>			
10.	Central Food Technology (Bombay Division)	11	1
11.	Cotton Technology (Bombay Division)	194	23
12.	Central Public Health Engineering Zonal Station (Bombay)	35	4
			28
Total No. of Women – 414 + 28 = 442			
<i>Public Research</i>			
<i>Joint Sector</i>			
1	Bombay Textile Research	210	7
2	Sasmira	131	5
3	Wool Research	28	5
			17

**PRODUCTION  
Private Sector**

<i>Sl. No.</i>	<i>(Companies with R &amp; D/Bombay)</i>	<i>Total Staff</i>	<i>Women with Science</i>
1.	Amar Dye Chem	1470	3
2.	CIBA	2345	9
3.	CIPLA	493	4
4.	Geoffery Manners	451	2
5.	Hindustan Lever	8129	7
6.	Polychem	600	1
7.	Raptakos Brett	294	7
8.	Zandu	600	4
9.	Tata Consultancy	497	9
10.	Larsen & Toubro	7000	7

Total No. of Establishments 10.

Total No. of Women 53.

**PRODUCTION  
Private Sector**

<i>Sl. No.</i>	<i>Pharmaceutical Companies</i>	<i>Total Staff</i>	<i>Women with Science</i>
1.	Abbot	658	9
2.	Chowgule	251	3
3.	Johnson & Johnson	944	9
4.	Glaxo	4062	40
5.	Boeringer Knoll	668	3
6.	Burroughs Wellcome	813	2
7.	Fulford	157	2
8.	E. Merck	1032	6
9.	Griffon	277	2
10.	Hoechst	1938	21
11.	Kemp & Co.	115	4
12.	Merck Sharp & Dome	820	7
13.	Parke Davis	953	5
14.	Richardson Hindustan	588	3
15.	Scarle	345	6
16.	India Schering	259	2
17.	Mack Lab	400	4
18.	May & Baker	1436	13
19.	Pfizer	3038	14
20.	Rallis	1690	7
21.	Wyeth	355	1
22.	Corn Products	306	1

Total No. of Establishments 22.

Total No of Women 164

**SERVICE I**  
**Public Sector**

<i>Sl. No.</i>	<i>Hospitals and Medical Colleges</i>	<i>Total Staff</i>	<i>No. of Women with Science</i>
1.	Acworth Leprosy Centre	100	1
2.	Nair & Topiwala	1427	20
3.	Cama & Albless	532	8
4.	KEM. Complex + G.T. Hospital (Including Children's Wadia, Children's Orthopaedic)	2711	44 (43)
5.	J.J. Group + Grant Medical College	2856	17
6.	St. George's Hospital	532	4
7.	G.T. Hospital	758	5
8.	Lokmanya Tilak (Slon) Hospital & College	1738	27
9.	Bombay Port Trust	498	6
10.	T.N. Hospital (Sewri)	651	6
11.	ESIS Hospital (Worli)	877	1
12.	Cooper Municipal Hospital	723	11
13.	Bhabha Municipal (Bandra)	308	4
14.	Mahatma Gandhi Memorial	1300	6
15.	Kasturba	684	9

Total No. of Establishments 5.

Total No. of Women 169.

**SERVICE II**  
**Public Sector**

<i>Sl. No.</i>	<i>Government Departments</i>	<i>Total</i>	<i>Women with Science</i>
1.	Bombay Natural History Society	29	2
2.	Fertilizer Corporation (Bombay Region)	2367	2
3.	Forensic Department	196	4
4.	Meteorological Division (Bombay Zone)	480	11
5.	Drugs Control Lab.	110	15

Total No. of Establishments 5.

Total No. of Women 34.

**SERVICE III**  
**Private Sector**

<i>Sl. No.</i>	<i>Hospitals</i>	<i>Total Staff</i>	<i>No. of Women with Science</i>
1.	Nanavati	620	8
2.	Bombay Hospital	1690	3
3.	S.K. Patil Arogyadam	200	3
4.	Jaslok	844	17
5.	Bhatia General	213	1
6.	Breach Candy	275	1
7.	J.B. Petit	392	2
8.	Safce	80	1
9.	Harkisondas	600	10
10.	Podar Hospital	228	1
11.	Bhikubhai General Hospital	160	5
			52

Total No. of Establishments 11.

Total No. of Women 52.

**REFERENCES**

- Barnabas, Manorama (1976): "Influence Bearing Upon College Students Today and Directions in which these Influences Operate in National Science Courses". *New Frontiers*, Vol. 6, No. 4, (October-December).
- Becker, Garys (1964): *Human Capital – A Theoretical and Empirical Analysis with Special Reference to Education*. New York: National Bureau of Economic Research.
- Bernal, J.D. (1969): "Social Function of Science" *History of Science*, Vol. 1, London: Pelican.
- Blumberg, Rhoda & Dwarki, Leela (1980): *India's Educated Women – Options and Constraints*. New Delhi: Hindustan Publishing.
- Bridgman, P.W. (1958): *Quo Vadis in Science and the Modern Mind; A Symposium*. (ed.) Gerald Holton, Boston: Beacon Press.
- Bronowski, Jacob [Ed.] (1965): *In Science, Its Method and Outlook*. Directorate of Education, Bombay: Aligarh Muslim University; Asia Publications.
- Chakaravarthy Radha et. al. (1984): *The Status of Women Scientists in India: NIS-TAD*.
- Cole, Jonathan (1974): "Fair Science: Women in the Scientific Community". New York: Free Press.
- Conant, James (1952): *Modern Science and Modern Man*. New York: Double Day Anchor.
- Cornelius, Benjamin (1970): in *Science and Society*; Alexander Vavoulis and Wayne A. Colver (Eds). New York: Holden Day.
- CSIR (1979): "Foreign Study of Women". *Technical Manpower Bulletin*, Vol. XV No. 3 (October-December).
- CSIR (1982): *Post-Graduate Women Scientists*, *Technical Manpower Bulletin*, Vol. XXIV, No. 10 (October).
- Dingwal, Robert & Lewis, Philip (1983): *The Sociology of Professions*. London: Mc-Millan.

- D'Souza, Victor (1975): "Family Status and Female Work Participation" in Alfred D'Souza (ed.) *Women in Contemporary India*. New Delhi: Manohar Publications.
- Dube, Leela (1980): *Women in South East Asia*. UNESCO.
- Dube, S.C. (1977): *India Science Independence — 1947-1952* New Delhi: Vikas.
- Ellis, N.D. (1972): *The Occupation of Science in Barry Barnes (ed) Sociology of Science*. Hammondsworth, England: Penguin.
- Gandhi, M.K. (1958): *Women*. Ahmedabad: Navjivan Publication.
- Gore, M.S. (1968): *Urbanisation and Family Change*. Bombay: Popular Prakashan.
- Govt. of India (1981): *Report of the Working Group on Personal Policies for the Greater Involvement of Women in Science and Technology*. New Delhi: Ministry of Social Welfare.
- Hagda, Jan (1982): "Alienation Among Artists and Scientists". *Sociological Abstracts*, Vol. 30, Supplement 116 (August-December).
- Harding, Jan (1982): "How the World Attracts Women to Science", *New Scientist* (15 Sept.).
- Holton, Gerald (1958): *Science and the Modern Man*, Boston: Beacon Hill.
- Horner Matina (1969): "Women's Fear of Success". *Psychology Today*, Vol. 3 No. 6 (November).
- Hubbard, Ruth; Henifen, S. Mary & Freid, Barbara [Eds.] (1979) *Women Look at Biology Looking at Women — A Collection of Feminist Critiques*. Cambridge, Massachusetts: Schenkman Publishing Company.
- Huber, Joan & Spitze Glenna (1980): "Wives' Employment Household Behaviour and Sex Role Attitudes", *Social Forces*, Vol. 60 No. 1 (September).
- Ingram, R.H. (1985): "The Study of Science in India" *The Education Review* (January).
- Inkeles, A & Smith, D.M. (1974): *Becoming Modern. Individual Changes in Six Developing Countries*. Cambridge, Massachusetts: Harvard University Press.
- Jaisurya, D.L. (1970): "Ceylonese Research Scientists — Their Social Characteristics Cultural Values and Attitudes" In *Science, Technology and Culture* (Ed.) Surajit Sinha. New Delhi: India International Centre.
- Jaiswal, R.P. (1981): *Status of Working Men and Women Engineers — An Analysis Based on 50 Engineers in Kerala* (Unpublished paper).
- Kakar, Sudhir (1978): *Inner World*. Delhi: Oxford University Press.
- Kapadia K.M. (1955): "Changing Patterns of Hindu Marriage and Family" *Sociological Bulletin*, Vol. 3 and 4 (September 1954-1955).
- Keller Fox, Evelyn (1982): "Feminism and Science" *Signs* Vol. 7, No.8.
- Mehta, Rama (1970): *The Western Educated Hindu Women*, Bombay: Asia Publications.
- Mehta, Vimal (1979): *Attitudes of Educated Women Towards Social Issues*. New Delhi: National Publication House.
- Merton K, Robert (1973) *The Sociology of Science — Theoretical and Empirical Investigations*. Edited and with an introduction by Norman W. Storer; Chicago: University of Chicago Press.
- Michael, G. [Ed.] (1971): *Roles Women Play — Readings Towards Women's Liberation*. California, U.S.A.: Brooks Cole.
- Morehouse, Ward (1971): *Science in India. ASCI Occasional Papers*. Bombay: Popular Prakashan.
- Newman, James [Ed.] (1962): *What is Science?* New York: Washington Square Press Inc.

- O'Brien Mary et. al. (1983): "Feminism and Education: A Critical Review Essay" *Resources For Feminist Research* Vol. XII No. 3 (November).
- Oppenheimer, Robert (1958): *Growth of Science and The Structure of Culture in Science and the Modern Mind* (Ed.) Gerald Holton. Boston: Beacon Press.
- Papanek, Hanna (1983): *Class and Gender in Education — Employment Linkages, Selected Country Studies*, Boston University, U.S.A: Centre for Asian Development Studies (Working Paper).
- Phillip, Frank (1954): "Contemporary Science, in Contemporary World in the Philosophers of Science; Saxe Commins & Robert Lindal (ed) New York: Modern Pocket Books.
- Phillipson, Ilana (1982): Child Rearing Literature and Capitalist Industrialisation *Journal of Sociological Abstracts* Vol. 30 (October).
- Prasad, Bhagwan (1968): *Socio-Economic Study of Urban Middle Class*. New Delhi: Sterling Publications.
- Prakash, Padma (1984): "People Science Movements and Women's Struggle" *Economic and Political Weekly*, Vol. XIX No. 38 (22 September).
- Rahman A, Bhargava et. al (1973): "The Indian Scientific Community" *Science and Technology in India*. New Delhi: ICCR.
- Rao, G.R.S (1968): Emerging Role Patterns in the Family. *Indian Journal of Social Work*, Vol. 26 (October).
- Rose, Ann (1956): *The Psychology of Occupations*. New York: John Wiley & Sons.
- Ross, Aileen (1961): *The Hindu Family in its Urban Setting*. Toronto: Toronto Press.
- Rotenburg, Mordechai (1977): "Alienating Individualism and Reciprocal Individualism — A Cross Cultural Conceptualisation, *Journal of Humanistic Psychology*, Vol. 17 No. 3 (Summer).
- Russel, Bertrand (1954): *The Scientific Outlook*. London: George Allen and Unwin Ltd.
- Sabato, A.J. (1975): "Using Science to Manufacture Technology", *Impact of Science on Society*, Vol. XXX, No. 1.
- Saberwala, Satish (1985): "Modelling the Crisis: Megasociety, Multiple Codes and Social Blanks". *Economic and Political Weekly*, Vol. XX, No. 5 (2 February).
- Seetharamu, A.S. (1981): *Women in Organised Movements*. New Delhi: Ambika Publications.
- Seminar (1950) September.
- Sethi, Raj Mohini (1976): *Modernisation of Working Women in Developing Societies*. New Delhi: National Publications.
- Sharan, Rekha (1982): "Working Women to Agents of Social Change in India" *Sociology Abstracts*, Vol. 30 (August-December).
- Shiva, V & Bandopadhyaya J (1980): "The Large and Fragile Community of Scientists in India". *Minerva*, Vol. XVIII, No. 4.
- Shukla, S (1981): "Perspectives in Women's Education", *Educational Forum*, Vol. XXII No. 1 (January).
- Sinha Surajit (1973): "Indian Scientists — The Socio-Cultural and Organisational Context of Their Professional Environment", in A Rahman, Bhargava et. al. (eds.) *Science and Technology in India*. New Delhi.
- Singh, Yogendra (1973): *Modernisation of Indian Tradition*. New Delhi: Thomson Press.
- Singh, Yogendra (1974): *Academic Role Structure and Modernisation — A Study of University Teachers in Satish Saberwala (ed) Beyond the Village*. Simla: Indian Institute of Advanced Study.
- Smith Cantel, Wilfred (1965): *Modernisation of a Traditional Society*. Bombay: Asia Publications.



- Sparker, John (1981): "What is This Thing Called Science?" *New Scientist* (15 January).
- Stebbins R.A. (1960): Career: The Subjective Approach. *Sociological Quarterly*, Vol. 11 No. 1 (Winter).
- Storer W, Norman (1966): *The Social of Science*. Harvard University, New York: Holt, Rinehart Winston.
- Swaminathan, M.S. (1980): "The Goal of Social Emancipation, Educational Progress and Development of Higher Skills".
- Tilak, J.S. (1980): *Inequality in Returns to Education*. Hyderabad: Administrative Staff College.
- Visalakshi, S; Queresh M.A. & Gupta S.P. (1985) "Dimensions of Science and Technology Prizes – Overview of the Indian Reward System" *Journal of Scientific and Industrial Research* Vol. 42 (December).
- Ward, Barbara (1963): *Women in New Asia*. UNESCO.
- Weinreichhaste, Helen (1979): "What Sex is Science?" in Vinagh Hartnet (ed) *Women: Sex Role Stereotyping*. London: Tavistock.
- Welford, A.T. (1980): "On the Nature of Higher Order Skills". *Journal of Occupational Psychology*, Vol. 53 (June).
- Yogev, Sara (1983): Judging the Professional Woman – Changing Research, Changing Values, *Psychology of Women Quarterly*, Vol. 7 No. 3 (Spring).
- Ziman, John (1981): *Demisting or Demystification – Teaching and Learning About Science and Society*. Cambridge: Cambridge University Press.
- Znaniecki Florian (1940): *The Social Role of the Man of Knowledge*. New York: Columbia University Press.

# 3

## A Waste of Talent and Training?

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### I

#### Participation of Women in Science

Science and technology have played a major role in promoting the extraordinary rapid progress of today's developed countries, whether measured in standards of living and military capacity or expansion and quantum of human knowledge. Development implies efficient utilisation of both the human and material resources of a country. India, among the developing countries is unique in recognising the importance of science and technology in national development right from the start. Heir to a long and sustained effort in creative scientific output and considerable sophistication of English education, modern science did inspire some scientific output in the late nineteenth and early twentieth centuries. However, at the dawn of independence, the scale of our science and technology infrastructure was insignificant compared to the achievement of other developed countries. Within four decades, we have made rapid progress and built up an impressive and sophisticated scientific and technological base. What made this possible was that science and technology was a planned input in our development planning.\* The Scientific Policy Resolution of the Government of India, 1958 categorically put the rapid development of science and technology as a major objective of the country. The architect of this policy was Jawaharlal Nehru, who had an immense faith in science as the salvation of India. "It is science alone that can solve the problem of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people. Who indeed can afford to ignore science today? At every turn we

Sixth Five Year Plan 1980-85, Chapter on Science and Technology repeats this.

seek its aid. The future belongs to science and to those who make friends with science" (Nehru Commemoration Number, 1964).

In forty years, the scientific establishment of India has come of age. We have today over 140 universities and deemed institutions, with 2000 or more affiliating colleges, 5 institutes of technology, 150 engineering colleges, 100 medical colleges, 350 polytechnics. The system produces some 150,000 qualified scientific and technical personnel every year. In addition to these educational institutions, we have 150 specialised research laboratories and over 600 industrial research and development establishments. The total stock of scientific and technical personnel would exceed 3 to 4 million even by conservative estimates. Truly, in absolute magnitude, a phenomenal expansion that puts it as the third component of the total world's total scientific manpower (Seminar 1980). This is "success" of one sort. There is also the darker side. Has this taken us nearer to the goals of development?

From the beginning, two outcomes of science have been held important: (1) science to promote productivity (2) science as an instrument of social change; to lift the country into an enlightened, rational outlook — to spread such values and attitudes as would encourage the Indian society to take its rightful place in the twentieth century world. These two goals are closely interconnected but it is possible for the first to exist to some extent with a lesser development of the second, though the spread of science and its incorporation as an ethos in the whole society is not possible without the strengthening of the interconnection. Success has come partly in the building up of an industrial base and the accumulation of "human capital" but the real goals of development, to which these are but means, namely, the eradication of poverty has eluded us. The second goal remains unrealised too.

Massive inequality has not only persisted but has grown, negating the development effort of three decades. Some dimensions of this negation can be gauged from the following figures. India carries the largest single national mass of poverty (which is now 40% of our population), which is easily the biggest magnitude of deprivation recorded in historical time and geographical space, because these four million poor comprised 40% of total poverty population of a group of 36 severely poverty stricken countries of the world in the late seventies. As the poverty ratio has shown no significant upward or downward change,

this really means that the number of poor people has been increasing by at least 5 million a year due to population growth alone. The reasons for this failure are complex, arising from our social and political-economic structure which determines the priorities of investment.

There are distortions and wastages in the system that lead to vast numbers being unable to utilise their skills, their potentialities, because of unemployment. They are not able to contribute to development. India has the largest single national pool of unemployed – over 20 million person years. Of these, nearly three lakhs of science educated persons are without jobs. Surely, a waste of national effort.

The share of women in the poor and in the unemployed is alarmingly high. This is a matter of serious concern. Participation of women in public activities at all levels and in all spheres – economics, education, politics, culture is an index of development. When we compare the statistics of different countries, we notice that one of the principal differences between economically developed and underdeveloped countries is the fact that in the former, the number of women participating in the labour force, in the professions, in the education system, in cultural activities is proportionately larger in the latter. The process of social development implies progressive improvement of the status of women in society (Stevenhaga 1980). While status is a tricky word and participation can be indirect, invisible and unaccounted for, the fact remains that by many objective criteria, (education, health, standard of living) women's position in India is disturbingly low. Dr. M.S. Swaminathan, Member, Planning Commission, had observed, in his welcome speech\* to the symposium, "Indian Women in the Eighties: Development Imperatives" held in New Delhi, in September 1980 "Women in India have always played a major role in the economy particularly in agriculture, forestry, animal husbandry, handicrafts, etc. Ignoring the remarkable skills of women in planning development strategies reduces the development potential of the nation as a whole. Institutionalised interventions are necessary to harness these valuable skills of women to the cause of national development, to ensure a sustained and self-generating momentum for overall development". These are exercises in "ought". What is the present situation?

**The Goal of Social Emancipation, Educational Progress and Development of Higher Skills.**

We are concerned here with science education at higher levels and its utilisation. What is the record here for women? Inequality in education between men and women is a continuing phenomenon (male literacy – 46.74%, female literacy – 24.88% even in 1981 census) though women have made rapid strides since independence. As the focus of this paper is higher education, it will be pertinent to look at the record in higher education in general but more specifically, science education. In 1950-51 we had a little over 43,000 women in institutions of higher learning. By 1970-71, enrolment of women in higher education touched 6.5 lakhs. At present, it stands at 8.2 lakhs (1985-86). Twentyfive years ago women students were barely one-tenth of the student population of higher education but now they form more than a quarter.

If we turn to science education, women's enrolment has been increasing at an annual compound growth rate of 7.6%. This had led to increasing proportions of women in the total stock of science personnel of the nation. Of the total estimated stock of scientific personnel the women component is 14.6% of the total stock. While this seems impressive, women with higher education constitute only 3% of women in India. It will be seen from the table below that since 1950-51, enrolment of women has gone up twenty-six times while the number of women per hundred men has increased threefold.

Table 3.1 shows the enrolment of women as a proportion of total enrolment during the period 1974-75 to 1985-86. It will be seen that enrolment of women as percentage of total enrolment increased progressively from 23.4 per cent in 1974-75 to 27.2 per cent in 1980-81 and 29.6 per cent in 1985-86. In absolute terms, the number of women enrolled almost doubled during the period.

There has been progress in women's science education, but the mobilisation of this science-educated women power has been disappointing. It is true that rates of unemployment among the educated in general are going up because of stagnation in economic growth, and this has naturally affected both men and women. Discussion of this lies outside the scope of this present study. Detailed break-downs of unemployment were available only in the 1971 Census (see Table 3.4). The rates of unemployment for women are considerably higher. There are no unemployment figures for women science graduates in recent years.

**Table 3.1**  
**TOTAL ENROLMENT AND ENROLMENT OF WOMEN**

<i>Year</i>	<i>Total Enrolment</i>	<i>Women Enrolment</i>	<i>Percentage of Women</i>
1974-75	23,66,541	5,53,009	23.4
1975-76	24,26,109	5,95,162	24.5
1976-77	24,31,563	6,27,346	25.8
1979-80	26,48,579	7,89,042	26.0
1980-81	27,52,437	7,48,525	27.2
1981-82	29,52,066	8,16,704	27.7
1982-83	31,33,093	8,80,156	28.1
1983-84	33,07,649	9,40,253	28.4
1984-85	34,04,096	9,92,139	29.1
1985-86*	35,70,897	10,58,612	29.6

\*Provisional.

Source: University Grants Commission: Report for the year 1985-86, Section 12, Higher Education and Women, page 197, 199.

**Table 3.2**  
**WOMEN ENROLMENT ACCORDING TO STAGE**  
**(1979-80 TO 1981-82)**

(University Teaching Departments/University Colleges & Affiliated Colleges)

<i>Year</i>	<i>Graduate</i>	<i>Post-graduate</i>	<i>Research</i>	<i>Diploma/ Certificate</i>	<i>Total</i>
1979-80	5,99,493	71,963	7,331	10,255	6,89,042
1980-81	6,52,808	77,001	8,780	9,936	7,48,525
1981-82	7,16,249	81,645	9,581	9,229	8,16,704

Source: University Development in India: Basic Facts and Figures 1977-78 to 1981-82. Part I Section A. Universities Colleges & Enrolment. New Delhi: UGC.

Both society and the individual concerned have deployed considerable resources of time, energy, material to acquire this education. What are the benefits to the individual and society? As the next question, one can ask, what are the benefits to women from science education and what are their contributions to society? Magnitudes of unemployment indicate the degree of wastage. Even the employed women are not receiving equal rewards; nor are they able to give their best because of their role in the family, lack of incentives and discrimination in the system. This is true for all educated women. Tllak (1980) has computed the returns to education for men and women and her results show great disparity. The human capital approach may be dis-

**Table 3.3**  
**WOMEN ENROLMENT ACCORDING TO FACULTY**  
**(1979-80 TO 1981-82)**  
**(University Teaching Departments/University Colleges & Affiliated Colleges)**

Years	Arts	Science	Com- merce	Educa- tion	Engg./ Tech.	Medicine	Agri- culture	Vet. Science	Law	Others	Total
1979-80	3,97,914	1,40,098	68,051	34,497	4,428	24,426	1,101	202	10,975	7,350	6,89,042
1980-81	4,20,276	1,53,868	88,067	33,708	4,949	26,797	1,311	249	11,948	7,352	7,48,525
1981-82	4,54,990	1,65,666	1,04,964	34,383	5,866	29,792	1,390	352	12,309	6,992	8,16,704

Source: *Ibid.*

**Table 3.4**  
**UNEMPLOYMENT AND SUBJECTS FIELD AMONG POST-GRADUATE**  
**WOMEN IN SCIENCE**

<i>Subject Fields</i>	<i>Women as % Total P.G.</i>	<i>Unemployed Looking for Jobs as</i>			<i>Women Not Trying for Job as % of Total Women Students</i>
		<i>% total</i>	<i>as % W</i>	<i>as % M</i>	
Home Science	95.3	23.9	24.5	12.5	16.1
Psychology	46.5	15.3	22.5	9.6	27.1
Zoology	29.1	11.9	23.5	7.3	10.2
Botany	29.2	11.2	20.7	7.7	11.7
Other Sciences	24.3	12.6	21.6	9.9	16.9
Geography	15.0	11.1	20.3	9.5	19.6
Chemistry	11.5	7.4	16.0	6.3	11.1
Mathematics	10.4	11.1	21.8	9.8	10.6
Statistics	7.6	8.4	17.1	7.7	10.2
Physics	6.6	7.0	13.1	6.7	7.0
Geo Sciences	0.8	0.9	25.0	8.9	7.1
Agriculture	0.6	6.7	15.4	6.7	3.8

*Source:* CSIR (1978) Post-graduate Women Scientists.

puted on other grounds (e.g. that it ignores other non-economic variables) but the evidence she presents are interesting for illustrative purposes. She estimates the stock of human capital in 1971 and computes the returns by adjusting for the social costs of education for different levels by age and sex, and using the All India Consumer Price Index. We quote some of her summary conclusions:

- (1) The stock of human capital is highly unequally distributed among men and women. It is four times higher in males than for females.
- (2) Stock of human capital per capita is Rs. 1,102 among males but only Rs. 288 for females.
- (3) Stock of human capital per member of the labour force shows wide disparities between males and females, the disparity being of the order of Rs. 637.
- (4) Though primary education has a large share in the total stock, the flow of human capital is not developing fast at this level; but the rate of growth is very fast at higher education, being 48% for males and 64% for females.



- (5) Non-participation of women in the labour force is causing a huge wastage of educated resources and make investment in women's education uneconomic.

These findings corroborate what has been said earlier through the unemployment data presented. Detailed analysis of 1971 census data on unemployment among men and women through regression analysis by Sharma and Apte (1976) gave a rate of unemployment for science degree holders to be 57% for women and 33.9% for men. In the absence of evidence to the contrary, there is no reason to believe the picture has changed drastically.

The lower participation of women in scientific effort can be seen also from the proportion of women employed in research and development institutions. Women constituted only 4% of the full time R & D personnel; those involved directly in R & D work, excluding administrative and other auxiliary cadres constituted only 3.5% of the total.

Unemployment is of two categories: (a) job seekers not getting jobs, (b) non-job seekers. In the first case, reasons for unemployment are related to the job market situation arising out of the general economic situation. Success in getting jobs is a function of suitability of skills possessed, expectations etc. It is a matter of congruence between the individual job seeker's need and the realities of the job market. It is a question of supply and demand equation. For women, however, there are additional reasons for non-congruence; less mobility, less skill in exploiting opportunities, less access to information, etc. On the demand side, they are often the "less" preferred by employment agencies for various social reasons. Non-job seeking by women spring from a variety of causes, the major one being their special role in the family. Other factors such as their own attitudes and perceptions regarding their roles in the family and outside influenced by socialisation and social expectations play a part. There are also objective circumstances such as lack of alternative arrangements that could free them from their roles in the family sufficiently to enable taking a job. One strategy that may be employed by women to meet their responsibilities to the family and also pursue a career or hold a job outside the home may be to temporarily withdraw and then re-enter when the demands on them are less heavy.

This present study sought to explore some dimensions and causes of “non-use” of science education. Use of science can take place by: (a) direct participation in employment, (b) indirect participation by being an agent for disseminating science to other members of the family, particularly as mothers. Do science educated women “use” science this way?

Maharashtra, relative to its population, has a high proportion of science personnel. It had in the early seventies, 9% of India's population but 15% of post-graduate and 14% graduates science persons, men and women both (Fact Book on Manpower 1970). Bombay, a metropolitan urban area, has even a higher concentration. Job-opportunities are not only greater in number but a greater diversity is also available due to its concentration of industries and it being a commercial urban centre. How many women with science education do take up jobs and the pattern of their employment/non-employment can only be known through a detailed census. This study, chose therefore to do a follow-up of women post-graduates in science of the University of Bombay. While this would not represent the science educated women population, it will certainly help in throwing some light on the problem.

The objectives of the study were:

- (1) To find out the socio-economic background of the non-working science women.
- (2) To find out why women with post-graduate science degrees were not working.
- (3) To know the attitudes of these women to career and career women.
- (4) To know how they perceive the importance of science in their lives and to see whether any of it gets reflected in their day-to-day life.

The investigation sought to get some measure of the obstacles they face in taking up a science career and their general level of awareness regarding the role of science in development. It also sought to get some insight into their awareness regarding their own position in the society. Did they visualise their position as one ridden with contradiction? Did these women see themselves as having acquired a special resource? What did they want for themselves? How did they resolve or face conflicts between their aspirations and what they regarded as their commitments?

There were two dimensions to the study: (a) their circumstances and attitudes to work outside the home, (b) their perceptions of the usefulness of science education and what they did to "utilise" it. The first one was analysed through detailed questions regarding their education, family background, past job history, present job status. Did they have a serious commitment to a career aside from wanting a job? One way in which a commitment can be seen is in the degree of effort made to keep in touch with what is going on in their discipline, the level of involvement with professional organisations etc. Also, how highly did they regard science as a profession? What were their own motives for choice of science? As for the second, it is hard to separate the influence of science as such. Generally exposure to higher education and media can make a person well informed. What we sought therefore was how the women saw the usefulness. As science educated women how were they functioning in their day-to-day life, in their approach to various problems? To get a definite picture one would need comparisons with males and with non-science degree holders. This was beyond our resources. Hence what we present is not a comparative statement. We cannot say whether science-women are better or worse than other groups of educated women, but we can perceive some patterns and hazard some observations from the data.

The hypotheses put forward here are:

- (1) Generally educated non-working women are those who do not feel the economic pressure to work.
- (2) There is a pattern of withdrawal and a desire for re-entry in the job market.
- (3) Career and job are two different things. Women have not yet developed career interests though they wish to take up jobs outside the home.
- (4) There is difficulty for middle-class women in co-ordinating different roles. Resolution is in the form of compromise and this difficulty would be more for women choosing science as a profession.
- (5) Non-working women science degree holders though not working, may bring to bear on their day-to-day life, some of the training in science they have received. It is presumed that science education at post-graduate level will have some influence on their attitudes and thinking but the degree to which this happens may not be much in the present context.

The attitudes of family members and how far they were supportive or otherwise were also analysed with a view to understanding their influence in determining these women's ability to take up jobs. Items of day-to-day behaviour were selected to include the usual rituals performed in Indian families and other beliefs and practices such as superstitions, evil spirits, ill luck, omens, taboos, belief concerning eclipses, horoscopes, destiny etc. Did knowledge of science and scientific training mean something to these women when it comes to practices such as these? Secondly, did they utilise their knowledge of science in areas of domestic life which pertained to health, hygiene, food etc.?

This study though a small and restricted one, would, it was hoped, highlight some crucial issues regarding: (a) participation of women in science, (b) the role of science in society.

## II

### **Methodology**

The survey involved women who had qualified in science but were not employed. It was a complementary study to the previous one on women with science degrees working in science establishments in Bombay.

The coverage was limited to subjects listed under the science faculty and therefore it excluded the applied science and other technical courses. This was to: (a) prevent the scope becoming too wide and unmanageable, (b) to make it comparable to the earlier study by keeping the same definitions. Applied sciences are more directly vocational oriented and since one of the purposes of this study was to see how scientific training and exposure to its methods appear to the women themselves, choice of post-graduate training in pure sciences enables one to make the presupposition that students who opt for these courses have an aptitude for them. One has to of course make allowance for the possibility that this need not be the case in a situation as in India where all degrees are obtained to acquire "credentials" and do not frequently reflect intrinsic interest and aptitude. However, in the case of educated women, it was not an unrealistic supposition because, unlike for men a career is not a MUST and therefore women might be able to opt for what they have aptitude for within the limits of their financial resources and other social factors conditioning their choice. The focus on "pure" sciences also allowed one to assume that students exposed to it were to some extent

more aware of the scientific approach and its philosophical implications.

The universe for this study consisted of post-graduate degree holders in pure sciences and who were not in any paid work. The area covered was that of Greater Bombay.

### Sample Frame

The enrolment data from the University of Bombay register was collected yearwise from 1970-71 to 1976-77 (see Table 3.5). Names and addresses of all the women who had registered with the University for M.Sc. and Ph.D. were obtained for each year and a proforma was mailed to all of them to get data on how many were employed, how many were students and how many were unemployed. The first round of the mailed questionnaire brought less than 50% response for earlier years and slightly more than that for later years. Many could not be traced (see Table 3.6). The total number not employed according to this first round was 170 women; about 52 women had left Bombay; 285 women had begun to work which means out of the women who had responded, more than half (54.28%) were already working. If we remember that only 51% of the total 1,027 students for the years 1970-71 to 1974-75 had responded, it was possible that the proportion in the actual population may be different. Metropolitan Bombay with its greater job opportunities, might explain the large proportion of the women here being employed. The unemployed was 32% of those who had responded.

**Table 3.5**  
**ENROLMENT IN SCIENCE — UNIVERSITY OF BOMBAY (MALE-FEMALE)**

Years	FY/Int Sc.		B.Sc.		M.Sc.		Ph.D.	
	M	F	M	F	M	F	M	F
1970-71	15374	4878	6458	2987	734	348	241	35
1971-72	13783	4789	6981	3203	846	349	266	40
1972-73	13301	4970	5865	2873	984	453	367	52
1973-74	12331	5067	5484	2785	11046	451	366	13
1974-75	11450	4162	5359	2941	1237	500	432	833
1975-76	13699	4682	5297	2969	1200	534	408	88
1976-77	7306	2556	5672	3156	1248	587	561	145
1977-78	5164	2543	7142	3674	1224	624	352	151
1978-79	7905	2356	4205	1976	1120	672	402	155

However, as the field work got delayed, and the project actually began in 1978-79 only after a grant was received, a resurvey was done of the earlier group and years 1975-76, 1976-77 were also added. In some years, a few more women who had not responded earlier, now responded (e.g. in 1972-73, six more; in 1974-75, 19 more) (see Table 3.6). In the two years that elapsed between the two periods, many more had begun to work.

**Table 3.6**

Years	Number of Women Unemployed	
	First Round	Second Round
1970-71	14	5
1971-72	25	5
1972-73	37	5
1973-74	42	8
1974-75	52	10
1975-76	—	8
1976-77	—	41

The proportion of women who had joined the work force had increased.

**Table 3.7**

Years	First Round	Second Round
1970-71	62.65	68.3
1971-72	62.10	70.2
1972-73	55.46	65.6
1973-74	57.14	69.7
1974-75	36.69	57.0
1975-76	—	48.6
1976-77	—	48.6

The proportions are lower in later years because they are still freshly graduated and have perhaps not been as yet able to locate jobs.

Again, after the field work actually began, and the respondents were visited in their homes, it was found that this was the position:

Working	18
Studying	7
Out of Bombay	5
Not available	7
Total	<hr/> 37

These thirty-seven women had to be dropped and we were left with 45 women who were not employed. In other words about 22% of our sample had joined the workforce.

As the sample had shrunk considerably, it was decided that there would be indepth interviews of these 45 cases and they were to be treated as case histories and not as a sample survey. These 45 cases could not be taken to be a measure of unemployed post-graduate women scientists because first of all we have not included women who have passed from other universities and are resident in Bombay. Secondly, out migration has been another factor.

The case-histories covered detailed questions on the following:

- (1) Personal data (age, educational qualification, marital status)
- (2) Family background
- (3) Motivation for science
- (4) Degree of family support for science education
- (5) Reasons for not being employed
- (6) Past job history
- (7) Whether looking for job; if so difficulties faced
- (8) Attitude of respondents and families to job outside the home
- (9) Awareness of the value of science education
- (10) Involvement in science.

Of the 13 women who were unemployed at the beginning of our field work, 6 had already obtained jobs. All the involuntary unemployed women had tried several sources for obtaining jobs – answering advertisements, applying in likely places and when possible, tapping personal contacts. According to the group, the reasons for their lack of success in getting a job were: (a) the general unemployment situation, (b) employers demand "experience", (c) discrimination against women especially in industry, (d) the education system which is not specifically job-oriented.

### Marital Status

Of the 45 cases, 26 were married and 19 were unmarried. There were 18 women within the 26 married, who had young children (among these 18 women, only eleven were "postponing" entry into paid jobs.)

### Age Group

The selection being from recent M.Sc.s and Ph.D.s., the group was young, though there were 5 above 30.

Table 3.8

Age in Completed Years	Married Women	Unmarried Women	Total
20-25	9	16	25
26-30	12	3	15
31-35	4	—	4
36-40	1	—	1

### Educational Qualifications

The sample being *drawn* from post-graduates, this automatically determined the educational level of the 45 cases. There were 3 Ph.D.s.

Their job status was as follows:

- (1) 26 women were actively seeking work and were involuntarily unemployed.
- (2) 13 women were planning to take up employment in the future and were therefore "temporarily" unemployed, though voluntarily.
- (3) 6 women did not seek employment either now or later.

The second category of women who had "postponed" their entry in the labour force, were predominantly married women with young children; there being only two women who were taking up training — one intending to join B.Ed. and the other who was already doing a diploma course in Special Education (i.e., education of the handicapped).

In the third category, the voluntary unemployed, there was only one with small children; the two other married women had no children at the time of the interview. This category also included two unmarried women one of whom had a special problem.



**How good was their achievement in their final examination?**

8 women had a first class in both B.Sc. and M.Sc. Of the remaining, many did not do so well in M.Sc. as they had in B.Sc. 26 women had got a second class in M. Sc. and 4 women had got only a third class in M.Sc.

The motive for selecting science was most often to go in for medicine. Out of these 45 women as many as 21 had opted for science with a view to joining medicine. These 21 women did not succeed in their ambition; 8 because they did not get the required percentage at the intermediate level, one because the family could not afford the expenses of medical education and the rest because the family opposed it, saying, "It is not necessary to spend so much on a girl's education". Three women had wanted engineering but joined science as the second best, for the same reason as above, "Engineering was not suitable for girls".

<i>Discipline Spread</i>	<i>Number of Women</i>
Biochemistry	10
Botany	5
Zoology	4
Inorganic Chemistry	4
Physical Chemistry	4
Mathematics & Statistics	5
Physics	13
	<hr/> 45

When asked whether they regretted the choice of discipline only two said that they would have done better in some other subject. These were the maths-statistics group.

**Socio-Economic Status**

Judging by the parents' or husband's profession, and the nature of accommodation the group belonged to either middle-class or upper middle-class groups. All of them owned apartments, a few were in company-leased houses in well-to-do localities. One family owned the whole complex where they occupied one apartment. There was not a single family without part-time help for domestic work and 8 families had in addition full-time help also. Except 5 women who declared that they were entirely responsible for housework, all the others had family members to share the burden with — mothers, in-laws or other older members, in varying degrees. Most of the families in which the respondents were then

living were in nuclear units i.e., 31 of them; 14 respondents lived in joint families.

### **Job History**

25 women had worked in the past. Of these 18 were married women who had discontinued after marriage, one of them after working for 6 years. The 7 unmarried women faced service termination because their jobs were temporary. These women had worked mostly in teaching (13) and research (5). Three women had worked as laboratory assistants and only 4 women had worked in administration or other lines unrelated to their qualifications.

### **Jobs Sought**

Given a choice, 18 women would have liked part-time work; and the others preferred teaching or research. Two women preferred opening their own pathological laboratory. One woman wanted to open a cosmetic unit, 7 others wanted to help their husbands.

In 33 cases the family's attitude to these women's education was supportive in the sense they felt higher education was useful but only in 5 cases did the parents back them strongly even if obstacles rose.

The group thus came from middle or upper middle-class homes, could afford servants and had parents who generally valued higher education for women. However, choice of courses was a different matter. To some "it was not necessary to spend so much on a girl's education" because she was going to get married. Engineering as an option was not considered. Medicine was desirable but only if "finances" permitted. There were powerful compulsions to work; even out of this small sample of 45 cases 25 had indeed worked earlier. Marriage was the reason for breaks in career especially when there were young children. After withdrawal for some years, these women wanted to go back to work. As many as 26 were actively seeking employment – this included half of the married women. In cases where some help was available or there was very strong support in the family, even those married and with young children continued with their jobs. Motivation to take up a job among women was strong, the "voluntary" unemployed being extremely small. The others who were unemployed even when not seeking work were in a sense "involuntary" unemployed, being forced by circumstances to

withdraw or postpone entry. The term "voluntary" in the case of women is an unsuitable description of their condition.

Detailed discussions on the women's own attitudes and perceptions are given in the following chapter. This will give some idea of the ambivalences they have and the contradiction created by higher education in advanced fields of knowledge to women; and to education and employment policy.

### III

#### **Towards Personhood**

This group of women had received a post-graduate degree in the sciences. Did this special field give them opportunities for self-expression and a sense of fulfilment? There are two aspects: (a) the experience of education in itself, (b) such education as a potential for continued progress in the future by some kind of active and sustained participation in it. How did these women visualise both these aspects in relation to themselves? What did they regard as hindrances to the realisation of their own potentialities? One major obstacle could be due to conflict between roles (Kapur 1969). When conflicts are experienced there is a feeling of stress. Self-actualisation is thwarted unless the environment provides a positive reinforcement necessary to nurture the self-regard and confidence of an individual. For women, this can only be done by providing them with opportunities to make decisions regarding their own destinies so that they can function as autonomous members of society. The drive towards the development of one's potentialities (i.e., self-actualisation) is a self-assertive process. Women have bodies that need exercise, brains that need knowledge and the power to understand and control their situation that such knowledge brings. They have emotions that need expression and channellizing. If opportunities are denied for all these because of their assigned and fixed roles in society they are unlikely to fully utilise their potential.

However, assertion of individual needs might conflict with other assigned roles of a person. Such assigned roles are regulated by the social norms and cultural values of the society in which the individual lives. The resolution of this conflict may take several forms: (a) co-ordination of the conflicting roles to harmonize them satisfactorily so that there is no stress, (b) underplaying one or the other roles in order to minimise conflicts, (c) avoiding a conflict totally by rejecting a role that is easier to reject

under the circumstances. The first is an ideal situation which requires an ideal society that caters to individual's requirements for personal fulfilment and growth and is in a position to provide resources and arrangements that would make this possible. Forgetting this utopia for the present the second and third are what most persons attempt to do. The kind of adjustments made and the choices made are influenced by the cultural norms and the institutions that maintain these norms. The choices available are also an important issue.

This is a very small study, with only 45 cases and therefore the reactions of these women and our interpretations of them are in the nature of observations only. However, the fact that the group is from a social class, which has been much studied and whose characteristics are fairly well known, these observations can be taken to have a broader validity also. The urban educated middle-class family to which this group belongs has some recognisable features: (a) usually it is a salaried class, (b) values education, (c) values stable marriages, (d) has a stake in family honour, (e) has more rigid moral standards of behaviour etc. (f) lays great stress on child care.

The middle-class is the creation of the British colonial era and the British education system. To this extent it is also vulnerable to greater social changes – in terms of Westernisation. The area and magnitude of tensions are also greater thereby. The experiences of these women are the compound of the changes that this class has been exposed to and the various ways and the degree to which accommodations are made. The manner in which accommodations are made imply various kinds of contradictions.

Some of the questions to which we were seeking answers were: (a) how deeply motivated were they towards their own self-growth, (b) how did they perceive their role as science educated women in relation to their other roles?

For the purpose of analysis, it was decided to divide the sample into four categories.

- (1) Those who have decided not to take up employment.
- (2) Those who are actively seeking jobs.
- (3) Those who have postponed their decision.
- (4) The doctorate holders.

It was felt that it would be instructive to know about the circumstances of each group and what their ideas, aspirations and perceptions were.

In the following accounts, fictitious names are used.

### **Women Who did not Wish to Take up Jobs at All**

There were 4 married and 2 unmarried women. The women hailed from economically secure backgrounds, as was revealed by their fathers' or husbands' job status, the kind of homes they had and the localities in which they lived.

Taking the two unmarried women first, both had guardians and parents who wholeheartedly encouraged their education. Their mothers had only middle-school level education but were very liberal regarding girls' education and employment. Both these women had worked for a brief period but did not like the experience. Zarina had worked as a research assistant in a company and Kumudini had been a clerk in an office. The ex-research chemist had a first class M.Sc. but she felt discriminated against because she was a woman, and gave up her job. Kumudini did not show interest in having any job. Neither Zarina nor Kumudini had any pressing need to stay at home. There were other members taking full responsibility for the household. Kumudini in fact had a model in the family. Her elder sister worked. She had made arrangements to leave her baby with her mother during office hours. Zarina's mother, a Muslim was unorthodox in her views and had given her daughter a great deal of push and encouragement and had in fact wanted her to go in for a medical career. Zarina did not share her mother's enthusiasm. She was keen to get married and felt that getting a degree was enough. Her mother and her brother, she complained kept admonishing her to "take up something useful and not while away her time at home". Likewise, Kumudini whose parents were prepared to give any help needed, did not regard her M.Sc. as a training for a working-life. She was proud of her science education and felt she was more intelligent than her other brothers and sisters who had only arts degrees. She felt a sense of achievement about this and valued it as status giving, but ill health prevented her from working outside the home. From her reports, it appeared that she had some emotional problems and the family not being in any severe economic hardship had let her be, even though they would have helped her equally had she desired to take up a job. For both Zarina and Kumudini their attitude to

paid jobs and science was rather limited and personal. Kumudini's case was peculiar and she had special personality problems. For instance, she attributed her illness to voodoo magic performed on her by a girl neighbour who was jealous of her "brilliance" and achievement in mathematics (she did not really do that well in her M.Sc.). She regarded science as useful to women insofar as the repairs of various gadgets at home were concerned. As regards the larger role of science and development, to quote her "our country's poverty is because we do not keep pace with the advanced technology of the West and because politicians are corrupt".

Both Zarina and Kumudini watch the science programme on TV but beyond that they spend their time reading popular magazines.

These two unmarried women were exceptions to the rest of the group. All the other unmarried women of the group (17 of them) were looking for a job except one who had got married before the field work was completed.

In Zarina's and Kumudini's case, there was no real "role" conflict because they had excluded work or career as an important area of life and had no other definite interests in either. Their self-actualisation motive was weak as they regarded their science not as something engaging their skills and talents and would help them grow but viewed their degrees as consumer-goods and status symbols despite parental support for a larger role. They had little knowledge of the social conditions of the country nor had they any awareness of their own class as a privileged one. It did not appear as if they were convinced of their role in the family as the only important one. Having comfortable economic circumstances, they could afford not to take on any serious responsibility that work involved. Both had jobs and gave them up. To them higher education was not a serious matter. These two cases are unusual in that there was no external pressure forcing them to conform. Boys would never have been given the luxury of "not doing anything". This is the negative discrimination against boys, that results from stereotyped roles.

The other four women who were all married were in the age group 20-25 years. They too come from well-to-do middle-class homes with highly educated fathers who were in the professions. Their mothers were also keen on their daughter's education. Shanti was ambitious and had aspired to do her Ph.D. but her in-

laws were against it. Poornima and Malati had in-laws who were not antagonistic to her employment but were unwilling to lend any special support. Both had been working and gave up their jobs after marriage. They felt, once married, their primary duty was to their homes. Savita's case was surprising. Her in-laws were very supportive and kept encouraging her to pursue her career but she herself had decided against it.

Malati said "My husband is a doctor. He is a very busy man. He helps whenever he can but we have both agreed that family life and children have the first priority".

Savita's remarks are worth quoting "Basically I am inclined to be at home and do house work and if at all there is an opportunity to use my knowledge I would prefer to give educational guidance. I do not like working under anyone. I want to be my own master. I think a woman should work only if the husband does not earn enough or if her father needs money for her marriage expenses". Savita was a first class student from SSC to M.Sc. and had held merit scholarships. "When minor breakdowns arise one can use one's knowledge e.g. to repair a kerosene pump, electrical equipment, mixers, gas, washers in faucets etc. Even if one does not do these repairs oneself, knowledge and awareness of scientific principles count a lot. Meals can be cooked scientifically, children can be brought up better. The role of a science trained woman is to help in the public education of science. If working in a scientific establishment in a technical capacity, she should take her work more seriously and do it earnestly." To Savita economic independence of a woman was not important as an ideology but she thought of a science trained woman as being useful in many ways.

All the four declared they watch TV programmes on science and read popular magazines but otherwise their link with their subject was limited. They valued their science education as something that had given them a special kind of knowledge but did not think taking a job was necessary.

There were contradictions in this kind of position. If scarce public resources are to be used, then some kind of return for society should be legitimately demanded. It could then become an argument for some to say that since women are only going to stay at home, why not a preference for men students for admission to science. Yet such a position would be unfair for many women who are willing to take up jobs if given the opportunity.

Secondly, there is another contradiction. Some women have an "easy option" because they have well-to-do husbands or guardians and have no compulsion to work and can be or are therefore willing to be full time housewives, while others struggle because they have no such option. In between are women who do not have dire economic necessity but work because they feel more fulfilled that way. Both contradictions prevent a resolution. Women who stay at home are receiving cultural approval; they thereby reinforce the "women's position is in the home" for all women and deny or make it more difficult for such facilities and arrangements to come up which will help talented women to use their talents for their own fulfilment as well as for broader purposes than the purely restricted one of looking after the family. Thus, inequality among different classes and groups of women complicate the issue. The less well-to-do woman, forced to work, may long to have it easy by staying at home and the highly skilled and motivated woman, would be more than glad to be able to work in her laboratory without troublesome additional burdens on her which a man does not have. *Merely having equal access to education, fails to resolve both the inequality between man and woman as well as the inequality between women.* The resolution of the contradictions cannot be only one way. If women want freedom to exercise their potentialities, it also behooves them to assume responsibilities. Inequality exists today because one gender has only one kind of responsibility and the other another kind of responsibility but along with that, the nature of the responsibility on women today excludes the cultivation of their other potential talents, skills and knowledge. If we have to enlarge the range of options for *both* sexes, we also inevitably must enlarge the range of responsibility for both sexes. Only by admitting that, will society come forward to lighten burdens for both of them — man and woman will then be equally parents, individuals and citizens in the fullest sense; both will assume obligations for the family and the larger society. The full time housewife doing unpaid work at home and the man, having paid employment outside is a recent phenomenon. When most production was within the home, women and men both were involved in it and it was easy then to combine motherhood-wifedom and economic participation — as it is done even now in the rural households. Cash payment and the emergence of work places away from homes makes for inequality between men and women. Further, highly professionalised work is not easily combined with women's other roles by doing it at "home" because while a good deal of manual



work can be interrupted easily, academic work or highly sophisticated intellectual work cannot be. Hence if women have to play their part in all the roles, some major readjustments are necessary.

There is no condemnation here of the women who opt to stay at home nor is there any implication that what they are doing at home is valueless. Far from it. Bringing up children is a social task — running a home is equally a social task. That their worth is underestimated is another issue. What is emphasized here is that in the case of highly qualified women, their non-involvement in public-production limits: (a) their own growth, (b) involves waste of public resources because these women are valuable human capital. Some individual women may opt to stay at home but many may not wish to, but are: either (a) forced to do so by family responsibilities or lack of support from society in recognising their needs, or (b) even if they do work, they have to do so under difficult circumstances. Women have no real option under (a) or under (b) because to exercise the "option" is to have penalties for doing so. If we are saying women are "wasting" the resources invested in them because they are not employing their skills one counter argument could be that they are better homemakers. An intelligent and a well educated woman is definitely an asset. Her outlook is expected to be broader, more enlightened. M.Sc. degrees are not necessary in that sense, though scientific knowledge in a broad sense is essential. Higher education is available only to a small proportion of the population. To contend that the M.Sc. educated women are "using" science at home can be an exaggerated claim. The possibilities of using M.Sc. level knowledge and skill at home are rather limited. Secondly, we find that the women's own perceptions of the use of science is limited to the enhancement of material productivity and while they do think of science as being of value, they do not appear to perceive adequately the role of science in creating a scientific temper.

### **Women Who Were Actively Seeking Work**

There were 8 married women and 11 unmarried women.

### **The Married Women's Group**

Most were in their late twenties, two being younger (22-23 years old). Their husbands were in salaried professions, engineers or scientists, some were doctorate holders working in research establishments of private companies.

The economic position of these women was fairly comfortable, their academic qualification was also good; one was a rotary scholarship holder. A couple of them had mothers-in-law who were resentful of the desire of these young daughters-in-law to work. They would much rather have them look after the household responsibilities. "We don't need their money; our sons are earning enough". The husbands on the other hand, were supportive of and sympathetic to their wives' ambitions. However, except in one case, where the husband did share wholeheartedly with housework and child care, the other husbands were sympathetic but did not do anything active by way of concrete assistance. They felt their wives had to sort out their "own" problems. One husband said "You are an educated woman. It is for you to be understanding even if my mother is conservative". His wife Kala, a botanist with very clear and strong opinions on the need for special benefits to women and who had given up her teaching job, was firm in her desire to seek a teaching job again. "A teacher is the most important contributor to the advancement in science". She would not have resigned had her mother-in-law been more co-operative. Her mother-in-law was also very old. The botanist believed that women should have economic independence. She did not wish to "waste" her education by sitting at home if it was not absolutely necessary to be at home.

Meenakshi, a physicist, had been a research assistant for 3-1/2 years. She said "There should be no reservation of jobs for women if we claim equality". She did not feel sorry that she had to give up her job after marriage. Her in-laws were well-to-do, owning the entire block where she lived. She had taken a keen interest in education for the handicapped. Her mother-in-law looked after her son while she went for the training course and her withdrawal was thus a temporary only. She wanted to do something for the physically disabled. In her case there was an independent interest and a will to carry it out.

Karuna was a first class chemistry post-graduate. Her husband was a manager in a firm. Karuna did not easily fulfil the expectations of her mother-in-law of an ideal, submissive daughter-in-law. "They wanted me to sit at home adorning myself and be a traditional 'bahu'," she said with considerable irritation. "As long as a woman's role is so defined that her first commitment is to her home and family, a woman gets less opportunities to fulfil other interests.... What can I do? I can't help my situation. I feel frustrated but now I am looking for a job".

All mothers-in-law were not so traditional. Biochemist Nina, 22, had married an engineer. Her mother-in-law was very progressive, and her husband was helpful. She was expecting a baby and as soon as the baby was a few months old, she would seek work. She planned to open her own pathology laboratory. Chitra was also lucky. Her husband and mother-in-law were both very supportive and she had held a teaching job for two years. She had a small child but was seeking a job. She was quite confident she could manage home and job without any trouble. She gave up for a while when the baby was very small and her mother-in-law was too sick to mind the baby at that time. "There is just too much responsibility on us women, when the childrens are infants," she sighed. Tara's case was different, because she was seeking re-entry after a number of years' break and she was now 38 years old. She had worked on a research job in zoology but married late. Soon after marriage, the responsibilities of household and children made it difficult for her to continue in her job. Her husband was also a scientist and worked in a pharmaceutical company. He was extremely busy and was unable to help out Tara. Tara's mother was a bright student too, who had won gold medals in her school career. Both her parents were very public spirited and ran a school in a village for poor children. Tara had not been able to get a job due to the unemployment situation and her own difficulties. "At that time I could not continue. I valued my education and enjoyed my job but could not place my interests above the family's". Had Tara been granted longer leave without pay or been helped to keep a line she would not have to suffer so heavily because she took a few years off to mind her baby.

All these women, felt the strain of a *forced withdrawal*. Seven had been employed in the past. They all needed easier conditions for re-entry. If there were part-time jobs these women would have gladly availed of it, kept in touch with their subjects and contributed their best. They would have been happier persons and to that extent happier mothers. For example, this group unlike the group discussed earlier maintained a lively interest in science and scientific matters, read *Science Today* and *Science Reporter* regularly and one of them went to her college frequently to obtain journals, helped with experiments and so on.

As for their general views on science, they thought "Science helps one understand the world better than arts. Science is not useful only for getting a job or bringing up children. It develops a

critical awareness, discourages blind faith". All of them felt that not only they but also their families and children benefitted from their scientific training. "It made us more confident to handle tools and gadgets". However, in their opinion, the present system of science teaching is too narrow and examination centered.

In their behaviour in day-to-day life and attitudes concerning traditional notions, there was less unambiguous "critical awareness". Without exception they all believed in destiny and that human life and its direction were only to a limited extent under our control. Six of the eight women observed fasts; 3 of them had taken vows when their children were ill. One woman confessed that she had consulted a horoscope when her husband was ill. Nina, of whose independence and clear views on women's role we mentioned earlier and who intended to open her own laboratory had some contradictions. She believed in the existence of evil spirits. She attributed this to a personal experience. In her family somebody suddenly took ill and medicines did not help. According to Nina, some "mantra" performance by her grandmother instantly cured the person. Menstrual taboos were observed by six of the women but only so far as desisting from the touching of "sacred" objects relating to worship. There were two women totally non-traditional who did not observe any of these customs. Tara, the zoologist and Chitra, the botanist, the two non-traditional women, declared rather vehemently when confronted with these questions on vows and taboos, lucky objects and evil spirits: "Of what use is our science education if we are going to follow blind beliefs?" To them science was not just a set of information on the natural world but a method of solving problems.

All these women felt differently about "destiny" and "God". The way they explained it was as follows. Science explains natural phenomena but over and above it all is some power over which we have no control. We can call this power "God". Destiny is phenomena over which we have little understanding or control.

### **Unmarried Women Who Were Seeking Work**

There were 11 cases, between the ages 22-25. Three had worked before but their teaching posts had been temporary and therefore they were now "unemployed". Of these 11 women, 2 women were deeply committed. "Marriage can never be a woman's goal. Even if a woman has no economic need, she should utilise her knowledge". For instance, 23-year old Mona, a

botanist was deeply interested in plant genetics and wished to pursue further study and research. Her job lasted only six months. She read as many as six scientific journals. Her father had a doctorate in engineering. Mona grew up in a family where there was plenty of intellectual stimulation and a liberal atmosphere. She recalled how even her brothers shared in the house work and cooking tasks at home. "When I get married, I will make my intention to have a scientific career quite clear to my in-laws and husband. There is definitely sex discrimination in the job market. Somehow men are preferred even if we are capable. Perhaps if I had studied commerce, I'd have fared better". Nita who had done microbiology in her M.Sc. felt quite excited and thrilled about her exposure to science. "I always wanted to be highly educated. True fulfilment lies in books. I like science best among all disciplines. It has among various branches of knowledge, the greatest explanatory power. I missed being a doctor, but microbiology satisfies my interest as it has close connections with human beings, diseases and remedies". Both of Nita's parents had a high school education. Her father had his own business. Both parents encouraged her to take her study and work seriously. Nita's words reflected her strong motivation, "I want to be independent, I will run my own lab. If I marry a doctor, then our work can be complementary. What I want is a husband not with "status" but who is understanding. Career and home are equally important for any person. Emotional fulfilment lies in a happy home, but it brings incomplete fulfilment without a serious work commitment. I must have both. I do not see any contradiction between my science education and my role in the family. Science education will make me a better mother because I would try to approach things with a scientific perspective. At home, a husband should have equal responsibility for home and children. Though a woman should seek marriage, she should seek other things for her development too". Nita had indeed thought through her situation and was likely to be an active controller of her own destiny. Nita was impatient that she had not got a job yet. College life was to her a very exciting, rewarding experience. "I never wasted my time on unimportant trifles".

Meena also valued greatly her training in biochemistry. She had held a government scholarship. Her parents had given her a lot of encouragement. She wanted a job immediately but did not have much success. "Even though women are capable, men are preferred" she adds plaintively. Arundhati had the same opinion.

"There should be reservations for jobs for women. With discrimination against women, we do not have the same chances as men though we have better qualifications". Vijaya, a chemistry post-graduate, was 22 and had just got married. She could not take up a job immediately as her husband was waiting for a posting abroad. Her mother-in-law had just retired from her school headship. Her own sister went to work though she had two young children. "I know what it means to run a home and have a job as I have seen my sister do it" says Vijaya. She looked back with pride and satisfaction on her childhood. Her parents were helpful, wise and able. Her father particularly took a keen and personal interest in the children's education and took great pains to assist their intellectual growth. They had many books on general knowledge and they were also encouraged to take part in various co-curricular activities. Her observations are worth quoting. "On the whole, science is a difficult career for a woman because to conduct experiments one has to be present in the lab. It is not like arts where one can take books home. If one is doing research, one has to wait for the results, one has to record changes etc. This means one must often stay back in the lab for long hours. Women with household responsibilities find this difficult. If a woman has to persist in her scientific career after marriage, the husband's co-operation is essential. He must be prepared to make adjustments that will help both of them. That way, a joint family can be an asset, provided the in-laws are helpful. One way in which a woman can manage her life better is to be aware of the difficulties ahead and plan her life accordingly well in advance so that career, marriage, children can all have a place. She should so plan that as soon as the children reach school going age, she can begin serious work. This can be done only if employers and government realise women's special responsibilities and make concessions for them. When women have very young infants to take care of, it is difficult to do serious work. If a woman withdraws, she loses contact with advances in knowledge for as things are we have no access to technical literature unless we are associated with an institution". Vijaya was indeed a very perceptive and alert young woman who had analysed her situation intelligently and was prepared to come to grips with it.

24-year old Smita was equally interested in taking up employment. She had an M.Sc. in physical chemistry, was a first class student throughout and had a UGC scholarship for her Ph.D. After working for sometime on her Ph.D., she gave it up be-

cause she was fed up trying to do research in a lab that had no facilities. None of the instruments would work. She was trying for a job. She felt it was especially difficult to get a job in industry where men are openly preferred. Her ideas on women and work were strong and definite. "Women have an equal right to all sources of knowledge. Why shouldn't women pursue scientific research with the same zeal and enthusiasm as the men?" She asked. "Why should working outside home harm the development of children? My mother worked. None of us experienced any difficulty. Actually, it made us self-reliant and independent. Women ought to have economic independence. Even the nearest and dearest on whom we rely will let us down one day." To her, her mother was a model, worthy of emulation, some one confident and capable. Smita had very positive things to say about science. "Science education changes one's way of thinking. A woman can influence her family members. She can acquire knowledge of herself, her body, her environment and learn to control it. I used to explain many things to my mother who was fascinated and thrilled at the new knowledge and new ways of looking at things".

Not all the women of this group were committed to working outside. There was one dissenting voice. Statistician Leela regretted she went in for science. She was not particularly keen on working. Home came first to her and she would work only if there was an acute economic need.

For this group as a whole, science was a liberating influence, was something that gave a special kind of awareness. It helped them to "analyse situations", to "think about problems" and refuse to "accept things on blind faith". Here is what one articulate woman said:

"We see that man rules the earth today. He levels the hills and bridges the streams. The tall buildings lift their heads to the sky, the steel tracks of the railways cross the plains and mountains. The man spans the ocean by boats on its surface, submarines beneath it and aeroplanes above it. He is the master of the scene he surveys... conquered the moon.... The increased production of food and clothing and the advances in medical knowledge cause an increase in population.... Thus, new inventions all the time keep on making great changes in human affairs. Then, ultimately the question arises how all these inventions are made at all? The answer is with the help of SCIENCE. Every

natural occurrence has a cause and effect. Science tries to correlate the divergent phenomenon of nature in a systematic way. It tries to explain what is going on in the universe and attempts to predict what is in store. The knowledge of Universe gained by human observations has been systematically classified into proper groups. In short, the word science means systematised knowledge”.

Some women said the interview stimulated them to think about things they had never bothered about before. These graduates came from a younger group and some changes were visible in their general attitude to women's work roles and the need for personal growth. They read science magazines (*Science Today* and *Science Reporter*) and one of them was a member of the Association of Microbiologists.

How did they relate these general attitudes to rituals and customs? The responses were mixed and not so categorical as their views that “Science dispels blind belief”. They observed fasts and vows, and one woman consulted a horoscope. With only two exceptions, all desisted from “touching sacred objects and did not worship” during menstrual periods; they all believed in God and destiny. However, they did not believe in things like omens, luck, evil eye, evil spirits etc. with one exception. This was the woman who believed in voodoo. There was one plant-pathologist, whose father was a Ph.D. in science and whose mother was a B.A., B.Ed., who did not even subscribe to the notion of any “destiny”.

There was thus a range in the degree of non-traditionality, there was also some selectivity in the choice of rejection or confirmation of customs and beliefs.

### **Women Who Had Postponed Their Decision**

This group had married women who planned to work later. They had husbands in the professions – engineers, scientists, doctors etc. Only one woman's husband was in business. Of the 11 women, six had worked earlier, for varying periods from 1 year to 3 years; an exceptional case was of a woman who had worked for 7 years. The six women who had worked earlier were all in the teaching jobs except one, who was in an administrative job. All of them had given up their jobs after getting married, invariably after a child was born. One woman had persisted in holding her job even after the first child was born but finally resigned because she could not cope with child care, when the second child was born. She did not get a good servant. Her husband and mother



had both helped her with the first child but when the second one came, her mother felt she should manage herself and the husband's work often kept him out of town. He was very considerate when he was around. Had this woman received proper support and been able to avail of child care facilities, she need not have given up her job. Take Suparna's case. She gave up her research job, though she liked it very much. Her in-laws were not in favour of her working and she had to succumb to their pressure. They had a full-time domestic servant and her mother-in-law, an SSC educated woman, was engaged in social work herself but would not allow her daughter-in-law to work. Suparna felt very frustrated. She saw no reason for her being forced to stay at home as there was a servant to help with housework. "My mother-in-law is liberal outside the home and enjoys the prestige of being a social worker but she applies a different standard within the home", she complained.

Kalpana's husband had a good salary. Her mother was prepared to help Kalpana by taking care of her baby but Kalpana's husband believed that a wife's duty was "home and child" before all else. Kalpana resigned herself to playing the role for sometime. She even gave up playing the sitar but when the child was older, she wanted to go back to work. There were only two cases where the women had made a choice on their own, even though there was no family pressure. One of them, Shilpa, had made a conscious decision not to work for some years. In her case, her husband and mother-in-law were eager to give her all the help she needed but she felt it was "her" duty to be at home for the children. Her husband was sympathetic. He was not in a position to help her much because he was often out of town. Ruchira had no special obstacles in the form of family opposition but had preferred nevertheless to avoid all tension by not taking up a job now. Career and home, according to her was not an easy combination. "If one wanted a career one should not marry" was her conclusion. "I do not get any help for looking after the children. My mother-in-law is too old to be able to mind the children. I am certainly not happy with just staying at home and I will take up a job as soon as the children are older".

All these women who had either given up their jobs or had postponed taking up a job saw themselves as playing a very important role in their children's intellectual, physical and emotional life. They regard their science education as giving them a special kind of insight and an understanding of "general prin-

ciples" which enabled them to handle various types of gadgets and practices regarding health, hygiene, food habits etc., with much greater confidence than others who had not been in science. This intellectual equipment that science gave them, they "used" at home, even if they were not actually employed in a scientist's capacity. Not all women saw the usefulness of science in this way. One woman, who was a physicist said that while no doubt they might be better housewives and mothers because of training in science, this was only in an indirect and vague way. Adequate utilisation of their special training could be made only if they were employed in a scientific establishment. For this, women must be given better opportunities. They did not have these opportunities in our present system. This physicist was also totally non-traditional, did not perform any rituals, like fasting and keeping vows or observing various taboos. She rejected completely superstitions regarding omens, evil spirits, ill-luck etc. Other women in the group were liberal in some ways and in some ways observed conventions. Observing fasts, keeping vows or abstaining from worship during menstrual period etc., they categorised as being religious acts and therefore not conflicting with science. Some could not say why they continued their practices; they felt comfortable continuing traditions they were used to. Their contacts with their subjects was only general, like reading *Science Today* and watching TV programmes. The progressive minded physicist was very active in the Indian Women Scientists' Association and tried to continue her links with professional associates. Some of them were socially aware also. One woman said that when her responsibilities to her children lessened she would like to work for the spread of science.

To summarise, the major features that emerged from the interviews with the group were that with one exception, all of them had to withdraw from work or postpone work because of opposition from in-laws or because they could not make suitable arrangements for child care. Those who had worked earlier felt very frustrated but appeared to accept their situation as "inevitable".

In all the cases, the difficulty or role conflict was not with respect to the housewife's or wife's role, but only that of mother's role and that too as *mother of very young infants*. Barring two husbands who did not understand the significance of work outside the home in promoting a sense of fulfilment and personhood but envisaged it only as an economic issue, all the other husbands were sympathetic to their wives' intellectual aspirations

and appreciative of their achievements. They however, did not seem to have any solution to offer and felt that temporary withdrawal in the interests of children would have to be put up with. That this was a serious social problem and changes in our work structure and family structure are necessary if women are not to be penalised for putting their children's interests above personal interests is not recognised by men. The women's tone of discussion clearly reveals a sense of loss, a feeling that such a "sacrifice" is necessary. They compensate this feeling of loss by saying they are "contributing" to their children's growth. Working women are also "contributing" to their children's growth in many ways. Only when child care available is unreliable or likely to be harmful to the child they need to feel any acute conflict.

They seek to resolve the conflict between their assigned social roles in the family and their own individual aspirations for stimulating activity and use of their knowledge and experience by surrendering their aspirations. They hoped this would be temporary. Conflict was avoided by postponement of decisions and by giving higher priority to a mother's role. This was itself not a bad thing but for the fact, that re-entry is either difficult or if obtained it is on less than fair terms. Our system has no means by which they can keep in touch with their discipline, there are no refresher courses to help them catch up. Even assuming they keep in touch by reading technical journals etc., re-entry at a later stage, puts them back in their career by a few years. For the well-to-do families, this may not be an economic issue, but the disparity between men and women career wise arising not because of differences in capability or achievement but only because women have to make a "sacrifice" (even if they themselves do not regard it as a sacrifice) is a *parity* issue, an equality issue. Women cannot be simultaneously individuals and family members — they have to be either/or. The predicament of these women can be partly met by part-time jobs. It will not make their position equal to men but at least it will give them opportunities to utilise their talents and training especially since their economic need is not the primary problem. They might even have enjoyed doing some research on modest honorariums which would have given them time to look after their children. Such schemes would ease the problems of re-entry in a labour market which is already saturated. However, the option for part-time work should not be exploited by employers who might assign women permanently to the part-time, part-paid category; for what

would happen to women who need to earn enough to support themselves and their families?

### **The Doctorate Degree Holders**

We decided to examine the responses and views of this group separately because they were highly qualified. Having got advanced degrees, how did these women take to unemployment? Was it voluntary or involuntary? What were their special circumstances? Did Rama, Priti and Nandita have a greater sense of involvement in science as a career? How did they look upon their roles? Rama was employed at the time of interview.

The socio-economic background of the three was the same as that of the rest of the women more or less, though Rama's position was not as happy economically as that of the other two. All three were married. They recalled a happy childhood. Rama had a twin sister, Priti was the eldest in her family and Nandita was the youngest in her family. In two cases, Priti's and Nandita's, the fathers were very influential. They imbibed their values and encouragement mainly from their fathers. Rama was different. Her role model was her mother. She said proudly, "My mother never trained me just for marriage. I am working now partly because I need to supplement my family income, but also because work is important to me. My husband not only helps me in my household responsibilities but gives encouragement and help in my professional work. My research work in plant tissue culture keeps my scientific interest alive. That is more important to me than the money it brings".

Priti was not so lucky. She held merit scholarships, had published 7 scientific papers and had worked as a research officer. She completed her Ph.D. after her marriage and continued to work even after she got her first baby. She had a tough time. Her father had given her plenty of backing and had made her in-laws agree that she should be allowed to work after marriage also. Her mother looked after her child. The parents were far away and she could visit the child on weekends and holidays. Her husband did not like the idea and kept insisting that they should bring back the child. The child was attached to the grandparents and could not emotionally adjust to the separation. The husband constantly nagged her and blamed it all on her job and unable to bear the psychological pressure, Priti resigned. A shortsighted husband had ruined the promising career of his wife. Priti was a member of a scientific society, read widely and was deeply com-

mitted to her scientific interests. Her parents-in-law were "very happy" at her decision to resign and they did not see what was important about her job. The child came first. "I want to get back as soon as I can but after so many years' gap what chance do I have?" says Priti woefully. A little support from her in-laws and husband would have made such a tremendous difference to not only her career but her self-confidence in managing both her roles.

Nandita was lucky because on the one hand she had no economic compulsion to take up a job and at the same time her husband and in-laws were very appreciative of her interests. She completed her Ph.D. after her marriage. As soon as her children were a little older, she planned to set up a production unit of her own. She helped her husband in his business. Nandita was very confident of her abilities and used her time to develop her many-sided interests. She ran her home very efficiently. To her, fulfilment had come not through employment, because she did not need one, but through the use of her talents for which she had found enough scope. "In my house, marriage as a destiny was never the idea given to us by our parents. Our parents continually emphasised the importance of education and doing something worthwhile with one's life. Though I give high priority to my role as wife and mother, I would have felt suffocated if I did not pursue my scientific interests. Fortunately I have been able to do both. If I decide to take up a job it will be purely my decision. My husband or in-laws cannot influence me. I will stick by my decision." Nandita is a strong minded person, who also had favourable economic circumstances. She displayed no sense of frustration. As she was planning self-employment, she would have no re-entry problem.

How did the Ph.D.'s. view their science education?

Rama said "Can science education be ever wasted? What do you mean by waste? We live in a world of science. We must make our children understand science; make them appreciate what it stands for. We cannot bring them up that way unless we ourselves are exposed to science and are deeply involved in it. Science education makes a lot of difference to one's outlook". Rama believed in "destiny" in the sense of forces beyond human control but otherwise does not follow any customs or taboos. Priti confessed that when her child was very sick she took a vow but otherwise she did not observe any fasts, or consult horoscopes

and other things. Priti was definite that science education had equipped her with a critical mind. Nandita, the spirited, confident and independent woman separated rituals and customs from her scientific work. "Why should they interfere with a scientific attitude? We perform these for getting some psychological satisfaction, to get some meaning in our lives. These things enrich our life. I am proud of being a woman and being able to do many things".

These three women had handled their problems differently. Rama was happy, fulfilling her family role and doing research. Priti was very unhappy but resigned — she had struggled for a time but in-law pressure became too much. Of the three, she was the most committed scientist. Nandita had chosen to give priority to her home and family and felt fulfilled; she kept her intellectual and creative interests alive by advanced study, hobbies etc., and planned to join or help her husband's business. In her case, hers and her husband's interests coincided — both were chemistry trained scientists.

These various groups had different problems and had attempted different solutions. There was only one small group of six women who were not seriously interested in anything. All the other women had been stimulated by their university education. Some of the married women were resigned to their inability to take up employment. Those married women who had worked for a few years felt the loss most of all. Their acceptance of "temporary withdrawal" was motivated by a conflict between their mother role and their own career. For a women, self-actualisation goals are viewed as "selfish" concerns which must be given up for the benefit of family welfare. It is not regarded as a valid goal for women unless economic need is a pressing one, in which case, the employed woman is seen as "serving" the family.

All these women placed a very high value on the proper upbringing of children, not just the physical care but their intellectual and emotional growth. Middle-class families and particularly the professional classes, see the need for considerable investment of time and energy to fit the children into desirable occupations and to maintain their present status in the society. Proper grooming of the child then becomes very crucial. Their own education sensitises them to these needs and their knowledge and skills equip them to do this job. Children reflect and uphold their social status. In the case of lower classes they

do not have the economic or the intellectual resources, living as they do from day-to-day to make such future oriented behaviour possible. Children in poor families are deprived of their basic childhood needs and for them the "presence" or "absence" of the mother makes little difference. Quite often the only way the children survive is when the mother earns and is able to feed them at all.

Historically, however, the situation was different for most classes of women. When families were large and women performed many basic productive tasks within the households and caste determined occupations this extra-ordinary investment of time, energy and resources on children was not necessary. By and large, children were clothed and fed; such rules of conduct as were appropriate to their status in society were imparted not necessarily by the natural parents but all concerned adult members of the family. Most mothers were far too busy attending to many household duties which a rural economy required by way of production. Twenty-four hour child attention is a totally new phenomenon. "Childhood" is a sociological concept (Aries 1962). It is what we think it is. Its contours and content have changed over time. "Childhood" as a special stage is a relatively modern notion even in Western societies. In many societies, it does not exist in the sense in which we understand it. In much of the Third World the majority of the population is under 18, but as statistics on child labour would show most of them assume family responsibilities and earning of livelihood at a pretty young age — soon after infancy and they quickly step into the affairs of the grown up world. The shift in focus on childhood also brought in a child-centered orientation.

People today think more about what is good for the children from the children's point of view. There is a special moral responsibility on the parent; the parent has to think in advance of the children's comfort all the time. The responsibility on the parents being heavy there is a sense of guilt and blame if things go wrong. The fault is no longer the child's but the parents. Secondly, this also means there is a heavy emphasis on education of the child. "Developmental psychology" further reinforces this responsibility for the emotional-mental-development of the child's personality. These values have come to us through Western education and urbanisation. Industrialisation and urbanisation leading to simplification of household work, availability of servants, modern amenities and most important of all, fewer children, have

changed the nature of women's work within the home for middle-class urban families just as it has done historically for Western countries. Mothers have more time for children at the time when child-centred values are also being adopted. There are other factors which make such an investment of time and energy in the upbringing of children a great necessity. Growing competition for white-collar jobs in a near stagnant economy introduces great stress for large numbers of educated people seeking white-collar jobs either to retain their parents' social status or to improve it upwards. The middle-class in India (Misra 1961) is the creation of colonialism and industrialisation. What is happening here is what happened in the West a century ago with mass education and industrialisation. In a country where the family was always the source of honour and status this process has intensified the emphasis on the family as the means of achieving success. These are the many pulls and pressures. While the extended family in earlier times was a more truly communal unit, today's emerging nuclear units are more individualistic. The family in earlier times concerned itself with status and tradition through marriage, observances of prescribed rituals and the appropriate set of social networks. In a more mobile society with a market economy as in today's world, the middle-class family faces competition from other units. On the positive side, we see that the resources available to urban middle-class families have increased but on the negative side community centred support is dwindling. Added to this is the lingering notion that a woman's proper place is in the home. What is forgotten is that the "home" of yesterday was also the workplace. When the workplace and living place were the same, women did both tasks – what is now regarded as "house work" plus the productive tasks of the economy. While the nuclear family poses problems for women, even in the joint family (as seen in these samples) the in-laws emphasize that the young mother must look after her child herself.

#### IV

#### **Science As Knowledge And Science As An Outlook**

How did these women who had taken post-graduate degrees in science understand science? What made them choose it? Did it impinge on their personal lives, did it affect the way they did things and thought about issues and problems in their daily life?

They were attracted to science because: (a) they were good at science and mathematics, (b) they had (half of them) ambitions to



go in for medicine; (c) they liked practical work better than just reading as in the arts. They had a feeling of special status, of a higher intellectual accomplishment. Medicine as a career for women was accepted early in the history of women's education in India. This traditional choice still carries weight but there are many more constraints now — high cost of medical education, the need for higher medical degree and the difficulties of private practice for women. Compounded with this are factors that affect both men and women, such as the competition for entry into medical colleges far beyond the capacity of colleges to absorb them. The colleges, in an attempt to cope, have constantly raised the admission requirements in terms of examination marks. In the present sample, 2 women could not take up medicine because of financial difficulties in the family which showed preference to their brothers' higher education, but the other 19 (women) did not qualify for entry into a medical college. It would be interesting to see what percentage of potential aspirants among men do succeed.

To get some idea of how they perceived the usefulness of science to themselves, a series of questions were asked where they had to respond to alternate choices and select the one that seemed the most important. The alternatives were:

Science promotes (a) objective thinking; (b) empirical approach; (c) inquiring mind; (d) removal of blind faith.

The largest number selected, "freedom from blind faith".

What was the usefulness of science to them especially as women? There were three variations in the answers: (a) not much said a few; (b) there is some special gain, said more than half; (c) 5 or 6 thought it made a great deal of difference. Some responses were as follows:

"It makes a woman more open to the world"

"It makes her think like a man"

"It helps women become better housewives and better women. A woman can make or mar the character of her children. Science helps her lead a fuller life and fulfil her responsibilities with greater understanding".

There was thus a distinct idea among these women that science had a beneficial influence on them. Again and again, one heard that "they would be able to bring up children better".

To seek what influence their science education really had on their lives, in their day-to-day practices at homes, they were asked two sets of questions one relating to child care practices at home and the other on the performance of various customs. Customs and rituals covered were, keeping fasts, taking vows, observing taboos connected with menstruation and not consulting horoscopes, not watching eclipses because they are considered ill-omen; beliefs in such things as the existence of evil eye, evil spirits, lucky-unlucky objects etc., attitude to ideas such as destiny and God. Child care practices followed were examined from what they did specially as science educated women.

The answers were not uniform but some kind of a pattern seemed to emerge:

**Table 3.8**  
**BEHAVIOURAL RESPONSES**

<i>Customs</i>	<i>Number Observing the Custom</i>			<i>Number not Observing</i>
	<i>Married Women</i>	<i>Unmarried Women</i>	<i>Total</i>	
Keep fasts	15	9	24	21
Horoscopes consulted during marriage and any crisis.	7	6	13	32
Keep special vows.	9	6	15	30
Observe menstrual taboos by refraining from worship or touching sacred objects.	15	14	29	26
Believe in lucky/unlucky objects.	4	3	7	38
Believe in evil eye.	2	3	5	40
Believe in the existence of evil spirits.	2	3	5	40
Believe in religious measures to cure illness.	6	1	7	38
Use home remedies to cure minor ailments.	21	15	36	9
Firmly believe in destiny.	21	16	37	8

The continuance or avoidance of a custom or tradition appeared to be influenced by what were part of religious tradition; there was for instance, much greater predisposition to observing fasts than beliefs in evil eye etc. which could be termed superstitions or "blind" beliefs. Even with regard to fasts, the reason they gave was that fasting was good for health. Even when the connection was religious (as obvious from the days or events marked by fasts) they felt more comfortable by giving some rational explana-

tion. Horoscopes were not used by most of them and the few that did, applied it for "crisis" situations. The women who admitted that their parents consulted their horoscopes before settling their marriage, also expressed doubts as to whether they themselves would do so for their daughters. Taking vows was a very special behaviour prompted by some kind of anxiety and a desire for reassurance. All the women admitted that illness had natural causes, but some of them sought psychological support in religious measures in times of emergency. As regards watching the eclipse (there was a solar eclipse during 1979-80), the convention was that eclipses herald some kind of disaster and they were thought to have a bad effect on one's self if one watched them, because of the Rahu-Ketu myth. None of our respondents adhered to this myth, they had watched it on TV, had explained the phenomenon to the children at home. Only one woman could not see it because of strong objection from her mother-in-law.

There was a noticeable rejection of many superstitions and beliefs and an adherence to scientific explanations of natural phenomena was observed in these groups. However this was qualified by falling back on some practices to get psychological reassurance in distress situations. Some customs were clearly regarded as religious practices, but even here, there was no unanimous adherence to them.

In the previous study given in the beginning of this book, it was noticed that while no clear cut statistical correlation was possible to establish because the questions were not in a quantifiable form, there was some influence visible in terms of two variables; age and family background. Perhaps this group's more pronounced non-traditionality and more open rationality than the earlier group could be partly explained by the younger ages of these women. While the other study included graduates, this study was confined to post-graduates of Bombay University. One might say, living in Bombay might have had some influence also. In a small study like this, without sophisticated analytical tools to isolate the influence of science education from other intervening variables such as urban atmosphere, general education, family background etc., it is not possible to measure the impact of science education. We are not in a position here to say, whether science educated women are better than other women of similar background. Nevertheless, it was significant that science educated women perceived science education as an important contribution in their lives. This was the positive aspect.

Is science perceived as specially useful to them in their family roles? They all thought it was. To the detailed questions on what they really did at home that would show their knowledge and attitudes, they mentioned that as housewives they paid special attention to cleanliness, hygiene, balanced diet etc; that they were more knowledgeable about the action of different drugs and when they could be given and why; they had more detailed knowledge of scientific principles. As mothers, they regarded themselves as capable and informed mothers, concerned with the all-round growth of their children, physical, intellectual and emotional. How did they make their children science-minded? Mainly by giving explanations when needed and supplying them with general knowledge books. On the issue of sex education, they agreed that it was necessary but "should be given at the right age, preferably by fathers to sons and by mothers to daughters to minimise embarrassment".

Two observations seem pertinent here. Scientific knowledge on matters that concerned what was clearly perceived as "natural phenomena" and where there had been visible progress, was incorporated more readily in their behaviour than its philosophic orientation. For instance in matters pertaining to the whole range of practices that related to the health of the human being (physical, emotional and mental) these women employed their scientific knowledge unhesitatingly. In matters that had an intimate relationship to religion, there was hesitation, reservation and ambiguity. Secondly, on broader issues of the entire philosophy of life that science stood for, there was far less awareness. In other words, the instrumental value of science was accepted more readily than the set of attitudes that could define an "outlook". Hence, they set aside science as the "Study of Nature" while God was above nature. Human intelligence could control "nature" but there were imponderables and the imponderable was the destiny we could not control. Their acceptance of science and its importance was selective, guarded and qualified.

Looking at it another way, in their responses to what they ranked as the foremost priority goal of scientific development in this country, higher priority was given to its knowledge aspect and productivity aspect. There was less priority given to the creation of a scientific outlook and science as a method of solving problems.

Science developed in the West in a way that became part of social life. Child care, housekeeping, management — everything began to be scientised. In India, this did not happen. While science and technology was considered important, a *specific* science and technology plan, apart from a general development was first prepared only in the Fifth Five Year Plan. But the incorporation of science and technology in the development process means more than the realisation that science and technology is “needed” for development. Science has to become a native plant in our society (Dedijer 1967).

Not only is there a distortion in the development of our scientific education due to the distorted growth of the economy but modern education in general was introduced in India with consequences that are well known. Many high level committees have detailed the ills that plague our educational system. The limited impact of science on the science educated is one of the consequences of an educational system that has proved dysfunctional to the real needs of a developing society. Its disfunctionality arises from its accommodation to the very structures that needed change. Methods of teaching in the system put a premium on the acquisition of credentials rather than the development of enquiring minds. To quote Malcolm Adiseshiah, “There is a rather large gap in the conception of our science and technology sub-sectoral plan. It is still limited to the physical, natural, engineering and agricultural science and technology leaving an aching void in the conjunctional use of the human, social and behavioural sciences and their technologies. The incomplete and partial assimilation of science and the scientific temper explains why persons highly educated in science are hesitant about accepting its philosophical implications (Zinn 1981).

For woman there is the added problem of status and opportunity within the social structure. Women’s access to education has been less easy. By their being securely tied to their families, they have been denied an independent identity. In recent times, especially after Independence women have entered higher education in science and other disciplines. Entrusted with the task of holding the family together, they are more reluctant to break with the older traditions.

While one may rue the incomplete transformation of our society into a “science” oriented society and find explanations for it in our history, and in the history of our educational system,

women's need for a right to scientific education is indisputable. The forthright answers of these women on many issues vouchsafe for that.

## V

### **Women and Development**

So far we have talked about the usefulness of science to women. What is the role of science educated women in our national development? It becomes significant to find out how much these women are committed to science. What is their participation in scientific organisations and how much is their interest in keeping up with rapid development in science? From the point of view of investment in science education of women also, such an enquiry becomes important. It is a well known fact that today women have equal opportunities for science education. There were an estimated 1 million science educated women in India. This means there is a high investment involved from the community's point of view. Has this investment paid off? What do these educated women do? How far do they use science for the benefit of society?

Women constitute half the potential human resources of the country and from the development point of view their contribution is very important. To repeat the words of Education Commission, 1966 (about women) "...She is now adopting a career of her own and sharing equally with man, the responsibility for the development of society in all its aspects". Again, to quote the words of Prime Minister Nehru "... It is by adopting the most vigorous measures and by putting forward our utmost effort into the development of science that we can bridge the gap" (Jawaharlal Nehru Commemoration Number 1964). Thus, a science educated woman is expected to play an important role. The present study included questions as to the role of women in national development. Many women did not know that public funds support university education up to two-thirds of the total cost and that fees contribute only 20%. "Why do you call it national investment? We pay fees"; said one woman.

How did they perceive the role of a science educated woman in the national development? Their responses said they could contribute "directly" if employed but contribute "indirectly" in a small measure by being good mothers. Most of the women regarded their being at home as a waste of scientific education and wanted opportunities for work. They felt that as individuals

they could not do anything and it was for the Government to devise schemes such that their knowledge and experience was not wasted. One woman said, "The role of a science trained woman is to help others understand more about science, make them see everyday happenings from the scientific point of view. If she is working she should take her work seriously. Whenever possible, she should help to improve the environmental conditions of the country".

They were anxious to work, barring six women mentioned earlier and felt there should be alternate arrangements for those with small children. "Self-employment is possible but it is extremely difficult for a woman to get the resources to start a manufacturing concern on her own". Women's role in the family was seen as coming in the way. "As long as a woman's role is so defined that home and children are her first responsibility and commitment, how can she play any specific role in the promotion of science?" asked a frustrated nuclear chemist with a first class career, who is eager to work again. She had given up teaching after marriage but is looking for a job despite strong objections from her in-laws.

The women we have discussed are those facing the usual difficulties – that of balancing home and career. They were not facing transfer, change of job or an intolerant husband. They did not experience any great tension. Their decision to stay at home seems to have arisen more from deeply embedded values (Goswami 1977).

What were the ideas of these women on the improvement of science education? Their suggestions were that: (a) courses should be "job-oriented", (b) laboratory facilities should be improved in quantity and quality, (c) more field visits and more interaction between students and staff should be provided for, (d) teaching should be more discussion oriented.

They felt that the defects of science teaching at present were: (1) Too much time was given to journal writing; (2) Specialization was introduced too early; (3) There were no aptitude-criteria for selection to science courses.

Asked if these women would have preferred to study some other discipline, except for two persons, all said a very emphatic, "No". The two who had doubts felt that had they chosen arts or commerce, they would have had greater job opportunities.

## VI

### **Concluding Remarks**

While women's contribution to the development of scientific knowledge has been significant in history, in modern science, their role has been limited. Places of work are removed from home and their social role as mother and housewife are regarded as primary. They are by and large groomed for marriage and no long-term plans for career are made. Nor is there any social arrangement that will release them from these responsibilities and enable them to play a fuller role. The scientific establishments and professional associations can address themselves seriously to this task.

The Working Group on Personnel Policies for bringing greater involvement of women in science and technology set-up in 1981 for the Planning Commission to incorporate a concrete programme in the Sixth Plan did take note of the special needs of women. The report of the group made far reaching recommendations. This is discussed in the earlier study.

It stressed not only fuller participation of women already trained in science but also the need to encourage more women to take up science and technology.

As in this study we are examining the non-use of highly qualified women scientists, it would be pertinent to look at the recommendations made by the Working Group.

"It is an admitted fact that while working women, particularly in professions, in the technical and scientific field require their commitment and concentration to make their full contribution and attain satisfaction and eminence, they also have to fulfil their social responsibility of bearing and rearing their children and helping them to become creative useful citizens of the nation. The personnel policies for women professionals therefore require an approach and combination of measures to enable them to fulfil those multiple roles without tension and feeling of guilt about neglect of any of their responsibilities. This involves questions relating to recruitment, placement, promotion, place of work, transferability, posting of spouse at the same station, grant of leave, hours of work and provision of supportive services".

This is a clear departure from earlier policies which while granting equal opportunity for education for women, did not recognise her equal right to direct social participation. Personnel



policies are based on the notion of the man as the bread winner who has a full-time house-wife to look after his needs at home. Therefore, the women who work outside, have to ensure a double-burden. It is not enough for family attitudes to change. Work-arrangements in work-places need reorganisation to take into account the new realities. If the woman can afford to stay at home and decides to do so to fulfil her social role as a mother, she is heavily penalized, for the standards applied to her are the same as for the working man whose parental and home responsibilities are not heavy. Thus, the right to equal education and employment are granted to women under onerous conditions which make it very unequal in the final analysis.

The Report recommends: (a) more liberal leave facilities for women in science-technology careers, (b) support services such as day care centres, (c) subsidised and processed food.

To avoid the necessity of having to quit their jobs because of small children, the Report suggests: (1) Retaining facilities; (2) Part-time and flexible hours if they re-enter to avoid dropout.

One recommendation is of significance; the need to improve the productivity of women workers and reducing the drudgery of their work and special attention therefore to sponsoring R & D schemes for these areas. Here women scientists can play a notable role. Unemployed women scientists may be involved in such schemes. This could be a special role of science-educated women in development.

While admitting that the Report is sympathetic to the needs of women, one danger of "special consideration" for women would be that this may result in their not being employed at all. Such special consideration would be necessary when children are very young; but one can minimise the need for discriminatory treatment by: (a) providing support services on a large scale, (b) shifting the (at present) exclusive responsibility of the home from the woman to the man in the family also. The Report accepts the present exclusive responsibility of the woman for the home.

The major departure needed in our social restructuring and educational planning is not to regard education as a contingency plan for women, but as a carefully planned preparation for their full and rightful participation in the national development efforts.

Apart from personnel policies of establishments of which the Report talks, professional scientific associations can play a major

role in involving women more fully, in making available technical literature, in providing refresher courses etc. Many unemployed women can easily lend a few hours every week in work connected with these associations. They can do voluntary work if money is not the main need for their working. This will help them keep in touch with their discipline, meet people connected with their own field and above all give them a feeling of fulfilment. Even if women's roles are "primarily" in the family, what happens in the outside world has far reaching repercussions on the family and its members. A mother does not function autonomously. She may disagree with the policies of the schools and school system and find them inimical to the true welfare of her children but if she is not involved in the decision-making process of the society at large, if her direct participation in these processes is limited or absent, what is the degree of control she can exercise within the home? The fallacy of full-time motherhood and regarding the family as a totally autonomous unit leads one into a cul-de-sac position. Science trained women staying at home can have little say in the direction and content of scientific development of the country. It is necessary to ensure their active participation in associations and establishments in a way that makes use of their knowledge and yet permit them not to jeopardise the health and welfare of the children (particularly) and other members. Fortunately, in the survey, there were very few science trained women who wished to stay at home. Those that work and those who would rejoin after a break, need proper facilities.

In addition to policy changes such as the above, both notions – the family and career need to be broadened. At present the members of the modern urban family share none of the wider functions of the earlier family unit. "My first duty is to my family" conceives of an individual's responsibility to society within narrow limits. Similarly, "career" is defined narrowly in terms of personal, intellectual, emotional fulfilment and not as a contribution to society and the development of the nation. To some extent, a man's career is viewed differently because he is supposed to "support a family" and not regarded therefore as a selfish goal of self-actualisation. For a woman on the other hand, her primary role being defined as being within the family, her career is something "extra" she can indulge in provided other conditions are favourable. (We are referring to the middle-class family. In the working class families, women are as much the economic

providers; however, even there, the middle-class norm will be regarded as the ideal, though unattainable due to poverty).

There is yet another factor. Right from the beginning of modern education in India, the goals of women's education have never been clearly formulated. What has been the underlying ideology is that of a liberal education. Education, it was expected would equip women with the accoutrements of a liberal culture. This has continued despite the pressures on the education system for vocationalisation, especially with regard to women. The value of higher education lies in the status that a degree brings, not its usability.

Solution to role conflicts and the creation of opportunities for women to participate more fully in the life of the community cannot be sought in an individual context. First, career needs to be understood not merely as personal fulfilment but as a *social obligation*. By the same token, bringing up children is not just an individual mother's responsibility. It is a social responsibility. *Mothering is a social task* and hence its social nature needs to be explicitly acknowledged. It will then not be thought extravagant to provide child care facilities for *all* mothers; not only those who are lucky to marry men with better economic resources.

Let us recall what the 1966 Education Commission had said: "In the modern world, the role of woman goes much beyond the home and the bringing up of children. She is now adopting a career of her own and sharing equally with man, the responsibility for the development of society in all its aspects". The Resolution on National Policy on Education had also declared, "the education of girls should receive emphasis not only on grounds of social justice but also because it accelerates social transformation". Brave words these. Alas, the implications of this were never perceived and the contradictions of upholding an ideal so much at variance with strongly held social norms never resolved by frankly facing them. The right of a woman to pursue her career is recognised and granted in principle without any attempt to reshape her role or other peoples' responsibilities in the family in any way. One qualitative change that seems to have taken place in the educated classes is that many husbands do not demand any service from their wives and are not "demanding" in their relationships. It is the mother-role where the maximum stress is felt because substitutes for a mother's personal care are either unavailable or are unsatisfactory. We are prepared

to entrust our children to the school system for 5-6 hours in a day and we are fairly helpless in altering or effectively controlling the school-system. It is therefore illogical that the physical presence of the mother beyond the early infancy stage is still regarded as important for providing suitable conditions for a child's growth. The answer lies in well-managed child care centres which can be controlled and supervised by other women.

The findings are not all one way. Our sample did include women whose mothers had given them new ideas and prepared them not to regard marriage as their only destiny. So, it is visible that some generational change has come in the attitude and readiness of some of these women to face their problems squarely. What is needed is proper mobilisation to bring in such policy changes and such social changes as would enable women to get same opportunities as men, *without* harming the interests of children.

These recommendations may be valid for all women with higher education, but they are specially relevant for science-trained women. There is a great need to use science and technology in all fields of endeavour, to lift the country from its present poor economic status to one that would ensure a decent and civilised existence for everyone. Should women be denied a chance to do so only because they are women?

#### REFERENCES

- Aries, Phillipe (1962): *Centuries of Childhood*. London: Jonathan Cape.
- Dedijer, Steven (1967): "Underdeveloped Science in Underdeveloped Countries", *Education Scientific Policy and Development* (Ed.) A.B. Shah, Bombay: Manicktollas.
- Fact Book on Manpower (1970): Col. III. Delhi: Institute of Applied Manpower Research.
- Goswamy, Nayantra (1977): *Self Image and Social Change*. New Delhi: Sterling Publications.
- Kapur, Rama (1969): "Role Conflict Among Employed Housewives". *Indian Journal of Industrial Relations* Vol. 5, No.1 (July).
- Misra B.B. (1961): *The Indian Middle Class – Their Growth in Modern Times*. London: Oxford University Press.
- Nehru Commemoration Number (1964): *Science Reporter*, Vol.1 No. 7-8 (July-August).
- Seminar: September, 1980.
- Sharma, G.P. & Apte, M.D. (1967): "Graduate Unemployment in India" *Economic and Political Weekly*, Vol. XI, No. 25 (10 June).
- Stevenhaga, Rudolf (1980): "The Invisible Women". *UNESCO Courier* (July).
- Tilak B.G. Jandhyala (1980): *Inequality by Sex in Human Capital Formation*. Delhi: Institute of Economic Growth (mimeo).
- Ziman, John (1981): *Teaching and Learning About Science and Society*. Cambridge: Cambridge University Press.

# 4

## Vocational Training - An Insufficient Answer

### INTRODUCTION

Education for national development and education for social change demand a substantial departure from the position of education as an academic exercise carried on exclusively as a student teacher activity confined to the four walls of the school. If education is to be related to the real life needs and aspirations of the people it must interact with the productive processes in the society.

The characteristic feature of the last two years of schooling, called the higher secondary, is diversification so as to avoid forcing the students into the academic channel alone and to give them an opportunity to choose subjects and programmes of study in keeping with their aptitudes, interests and abilities. There is a great urgency for designing a diversified higher secondary education in which the academic stream would cater to not more than about 50% of the students at the higher secondary level. A necessary feature of higher secondary education would, therefore, be the provision of a large number of vocational streams. UNESCO in its recommendations of 1974 on technical and vocational education defined it as a comprehensive term embracing those aspects of educational process involving in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life.

The development of technical education has been one of the major achievements of the post-independence period. The creation of the All India Council for Technical Education in 1945 and the Report of the Scientific Manpower Committee in 1947 had a far reaching influence on this development. The Apprenticeship Act

**Note:** Part of the field work for this study and data analysis was done by Sarita Date.

(1961), the establishment of the Industrial Training Institutes (ITIs), technical schools and polytechnics, all promoted the development of technical education in relation to the industry.

Despite repeated exhortation it is unfortunately still widely felt that vocational education at the school level is an inferior form of education, fit only for those who fail in general education and the last choice of parents and students. This is strikingly brought out by the Ministry of Education and Social Welfare, Government of India, in its 'Education in India' volumes. Considering all types of institutions including schools, higher secondary schools, colleges, universities, professional colleges etc., schools for professional and vocational education constitute only 0.37% of the total. The number of pupils in these schools form a mere 0.2% of the total number of pupils enrolled in all types of institutions. 41.32% of the pupils enrolled in schools for vocational and professional education are girls.

Considering the data for the period we find that the number of schools for vocational/professional education is still less than 0.5% of the total number of recognised institutions in the country. The institutions covered include schools, higher secondary schools, colleges, universities, professional colleges etc. The expenditure incurred on vocational education is less than 1.5% of the total direct expenditure on education and we see a steady decline in expenditure on vocational education as the years go by.

### **Technical and Vocational Education for Women**

Table 4.1 gives the distribution of the number of schools for vocational/professional education for the years 1950-51 to 1979-80 and Table 4.2 gives an index. Technical schools for girls have increased from 294 to 21,726.

In view of the current social prejudices against employment of women and their large scale displacement from employment as a result of structural and technological changes taking place in the economy, vocational training for women requires special attention and priority. This has been emphasized by the International Labour Conference in 1965 and the United Nations Commission on the Status of Women in each of its reports. UNESCO in its General Conference in 1962 has also underlined the importance of the access to girls and women of technical and vocational education. Developments in society require from women a much wider participation in all types of occupations besides family and domestic activities. Therefore, the facilities for

**Table 4.1**  
**NUMBER OF EDUCATIONAL INSTITUTIONS (SCHOOL-LEVEL) BY SEX,**  
**LEVELS & TYPES OF EDUCATION IN INDIA. 1950-51 TO 1979-80**

<i>Year</i>	<i>Schools of Vocational/Technical Education</i>		
	<i>Boys</i>	<i>Girls</i>	<i>Total</i>
1950-51	1361	294	1655
1951-52	2045	561	2606
1952-53	2189	605	2794
1953-54	2117	671	2788
1954-55	1599	715	2314
1955-56	2525	751	3276
1956-57	2460	791	3251
1957-58	2677	805	3482
1958-59	3025	798	3823
1959-60	3253	842	4095
1960-61	3503	928	4431
1961-62	3042	966	4008
1962-63	3110	992	4102
1963-64	3270	1111	4381
1964-65	2215	932	3147
1965-66	1798	977	2775
1966-67	1622	986	2608
1967-68	1612	986	2598
1968-69	1201	1033	2234
1969-70	1202	1083	2285
1970-71	1204	1133	2337
1971-72	N. A	N. A	N. A
1972-73	N. A	N. A	N. A
1973-74	N. A	N. A	N. A
1974-75	N. A	N. A	N. A
1975-76	N. A	N. A	N. A
1976-77	21667	4681	26348
1977-78	24047	5789	29836
1978-79	28030	7497	35527
1979-80	65550	21726	87276

Source: Educational Statistics at a Glance, 1987 Association of Indian Universities, New Delhi.

women in technical and vocational education should have the same importance and range as those offered to men. A special effort should be made in order to provide women with possibilities of personal fulfilment in the vocational field through technical and vocational education.

Table 4.2

**INDEX OF GROWTH OF EDUCATIONAL INSTITUTIONS (SCHOOL LEVEL)  
AND TYPES OF EDUCATION, INDIA, 1950-51 TO 1979-80**

*Base 1950-51 = 100*

Year	<i>School of Vocational / Technical Education</i>		
	<i>Boys</i>	<i>Girls</i>	<i>Total</i>
1950-51	100.00	100.00	1655
1951-52	150.25	190.81	2606
1952-53	160.84	205.78	2794
1953-54	155.54	228.23	2788
1954-55	117.48	243.19	2314
1955-56	185.52	255.44	3276
1956-57	180.75	269.04	3251
1957-58	196.69	273.81	3482
1958-59	222.26	271.42	3823
1959-60	239.01	286.39	4095
1960-61	257.38	315.65	4431
1961-62	223.51	328.57	4008
1962-63	228.50	337.41	4102
1963-64	240.26	377.89	4381
1964-65	162.74	317.00	3181
1965-66	132.10	332.31	3147
1966-67	119.17	335.37	2775
1967-68	118.44	335.37	2598
1968-69	88.24	351.36	2234
1969-70	88.31	368.36	2285
1970-71	88.46	385.37	2337
1971-72	N. A	N. A	N. A
1972-73	N. A	N. A	N. A
1973-74	N. A	N. A	N. A
1974-75	N. A	N. A	N. A
1975-76	N. A	N. A	N. A
1976-77	1591.99	1592.17	26348
1977-78	1766.86	1969.04	29836
1978-79	2059.51	2550	35527
1979-80	4816.31	7389.79	87276

*Source: Ibid.*

In India, the National Committee on Women's Education has pleaded strongly for better and more extensive facilities for vocational training for women particularly since the general educational system paid little regard to the needs of the industry and



commerce. Besides, the inadequacy of vocational training opportunities for women widens the productivity gap between men and women at all levels and women find it increasingly difficult to get employed. Training facilities when they are provided display the existing social bias regarding the suitability of particular occupations for women which leads to over concentration in a limited group of subjects. Courses considered "suitable" for girls are secretarial practice, dress-designing, electronics and radio-TV technology, interior decoration, commercial art, medical laboratory technology etc.

Technical and vocational education is responsible for training not only those who will seek employment but also for those who will create employment. In the present socio-economic set-up, self-employment of women requires much more than training in a particular productive trade. Without knowledge of the market mechanism and capital resources, training alone cannot help women to face competition. They need to be given supportive assistance in the way of training in organisation of production and marketing and in procuring capital and raw materials. This will be extremely beneficial to a majority of these young trainees to utilise their training in self-employment. The trainees must also be encouraged to think of setting up their own small enterprises or joining together with others in creating small scale workshops, industries or services needed in the community, on a self-employed co-operative or community sponsored basis. Such enterprises are encouraged under the Small Scale Industries Scheme and educational authorities have a responsibility to interest their students in these possibilities.

### **Technical Education in Maharashtra**

The Department of Technical Education in Maharashtra State was established in 1948 by the former Government of Bombay. Technical education at all levels in the State is entrusted to this department. It looks after technical education provided by such institutions as engineering and technological colleges, polytechnics, industrial schools, industrial training institutes, industrial training workshops, secondary and higher secondary technical high schools/centres etc. A Board of Technical Examinations was constituted in August 1963 to conduct examinations of diploma and certificate courses offered by polytechnics and technical institutions. In March 1981, the Department of Technical Education was further divided into the Directorate of Technical Education and Directorate of Technical Training. The

Directorate of Technical Training is responsible for craftsmen training scheme, apprenticeship training scheme, technical high schools and vocational training upto 12th Standard.

Table 4.3 gives the types of the institutions covered by both the Directorates for the year 1982-83 (excluding degree and post-graduate level courses).

Table 4.3

Type of Institutions	Number of Institutions		
	Govt.	Non-Govt.	Total
(i) <i>Directorate of Technical Education</i>			
Polytechnics (including cell of correspondence)	19	18	37
Other Diploma Institutions	5	40	45
Industrial Training Institutes	58	31	89
Technical High Schools/Centres	60	123	183
(ii) <i>Directorate of Technical Training</i>			
Basic Training and Related Instructions Centre	44	—	44
Industrial Schools	9	—	9
Vocations Centres at +2 Stage	8	210	218
Civil Engineering Asstt. Courses	28	—	28
Part-time Schools for Industrial Workers	6	—	6
Crafts and Other Technical Institutes (Certificate Level)	10	1098	1108
Total	247	1520	1767

Source: Annual Statistical Report of the Directorate of Technical Education and Directorate of Technical Training of Maharashtra, 1982-83.

The courses taken up at the engineering polytechnics besides diploma in civil, mechanical and electrical engineering are diplomas in electronics and telecommunications, metallurgy, textile manufacturing, electronics and radio engineering, plastic and chemical engineering, industrial design and decoration etc. The 5 diversified government and 40 non-government diploma institutions in the State cater to diploma courses in printing technology, leather technology, pharmacy, architecture, textile designing, dress making, stenography, food technology, dietetics, hotel management and catering, travel and tourism etc. Among these non-engineering institutions there are only 5 institutions

for girls with a total enrollment figure of 494 for the year 1982-83. The courses offered by these institutes are of one and two years duration in the following subjects: dress making and design, social communication media, travel and tourism, dietetics, stenography, and private secretarial practice. Other diploma courses considered "suitable" for girls are home science, interior design and decoration, cookery and bakery, confectionery, crafts, embroidery and fancy work etc.

The technical high schools/centres impart technical education at the secondary level. There are three types of technical high schools in the State. One is a full fledged technical high school, in the second type only a few divisions are converted into technical divisions and in the third, students from participating schools in the vicinity get training for technical subjects while they attend their parent schools for academic subjects. In the higher secondary schools or junior colleges, a student can opt for one optional technical subject at the + 2 stage in lieu of biology. The four subjects out of which she/he chooses one are:

- (1) Workshop technology and engineering drawing.
- (2) Elements of mechanical engineering and engineering drawing.
- (3) Elements of civil engineering and engineering drawing.
- (4) Elements of electrical engineering and engineering drawing.

The craftsman training programme is implemented in the State through the network of industrial training institutes (ITIs) located in all the districts of the State. Various types of engineering and non-engineering trades are taught through these institutes and the responsibility of turning out semi-skilled/skilled craftsmen in various vocations is thus entrusted with the craftsmen training programme. The main aims of this programme are as follows:

- (1) To provide vocational training facilities to youths educated up to S.S.C. level (8th Std. or S.S.C. pass) to enable them to undertake wage employment or self-employment.
- (2) To maintain an uninterrupted flow of skilled craftsmen for various industrial establishments in various vocations.
- (3) To arrange for systematic training to educated youths for maintaining the constant speed of production and

to increase productivity as well as quality of production.

Table 4.4 shows some of the different institutions in the State with their number and intake capacity (excluding degree and post-graduate level) for the year 1982-83.

**Table 4.4**

Type of Institutions	No. in Maharashtra			Intake Capacity (1982-83)		
	Total	Govt.	Non-Govt.	Total	Govt.	Non-Govt.
Polytechnics Capacity to Engineering Diplomas	37	19	18	6120	3505	2615
Institutions Catering to Diploma Courses other than Engineering.	45	5	40	2637	315	2322
Tech. High Schools/ Centres Introducing Tech. Education at Std. VIII level	28	28	—	1400	1400	—
ITIs	89	58	31	30644	27780	2864
Govt. Industrial Schools	9	9	—	773	773	—
Govt. Engg. Asst. Courses	28	28	—	840	840	—

Source: Annual Statistical Report 1982-83, Directorate of Technical Education, Maharashtra.

It is unfortunate that sex wise break up of the intake capacity is not available anywhere, which makes it difficult for us to give the percentage of girl students/trainees in every institution and for every diploma/certificate course. We collected data in Bombay city through field research which we give in Tables 4.7 and 4.8. It is possible to show only the turn out of students in

**Table 4.5**

Type of Course	No. of Course	No. of Students	
		Appeared	Passed
Diploma	29	7,480	5,099
Certificate	53	30,379	19,424
ITI Trade	89	17,476	11,825
Apprentice Trade	80	7,400	4,899

Source: Annual Statistical Report of the Directorate of Technical Education and the Directorate of Technical Training, Govt. of Maharashtra, 1982-83.

general according to the various courses for the year 1982-83 as indicated by Table 4.5.

### **Evaluation of the Working of the NVTI and the RVTI in India — A Report of the Bombay Study**

In 1974 the Govt. of India, in conjunction with Swedish International Development Agency (SIDA), conducted a research survey to study how vocational training for women could be more effective in providing for self-employment, wage earning employment and part-time income generating activities. As an outcome of this study the women's vocational training programme was designed. This programme was launched in 1977 by the Directorate General of Employment and Training in the Ministry of Labour Govt. of India with the assistance of Swedish International Development Agency (SIDA) and International Labour Organisation, (ILO). Under this programme three institutes were started, the National Vocational Training Institute (NVTI) in New Delhi and two Regional Vocational Training Institutes (RVTI) in Bombay and Bangalore.

The women's vocational training programme completed five years in December 1982. It was felt that an evaluation of the working experience of the five years of the project would be very useful in order to plan for the future and make necessary improvements in the programme content and functioning. In this context, the Institute of Social Studies Trust (ISST), New Delhi, drafted a proposal on 7 October, 1983. The evaluation was to be carried out in two parts (a) assessment of the extent of utilisation/wastage of training by the trainees, (b) evaluation of the working of the NVTI/RVTI itself. The second part of the project was to be carried out by the Officer of the Director General for Employment and Training. The Research Unit on Women's Studies was requested to undertake the Bombay part of the evaluation study.

**Aims and Objectives of the Institute:** A long range objective of the women's vocational training programme launched by the Ministry of Labour, is to increase women's participation in economic and social development directed towards fuller development of skills so as to make them economically independent. There is also an urgent need for identifying new areas and occupations suitable for women and their training arrangements in such fields. There are certain industries which may need retraining help for women workers due to change in technology of their products.

**Table 4.6**  
**TECHNICAL/VOCATIONAL INSTITUTES IN BOMBAY**

Name of Institution	Courses Offered	Enrolment for Years		
		Male	Female	Total
M.H Saboo	Mechanical Engineering	107	10	117
	Production Engineering	213	22	235
Siddik Polytechnic	Mechanical Engineering	120	—	120
	Civil Engineering	120	—	120
	Electrical Engineering (4 years)	120	—	120
	Electrical Engineering (3 years)	203	7	210
	Industrial Electronics	203	7	210
	Diploma in Interior Designing and Decoration	115	15	130
	Certificate in Interior Designing and Decorating	17	13	30
V.J.T.I	Mechanical Engineering	60	3	63
	Electrical Engineering	35	2	37
	Electronics Engineering	43	—	43
	Civil and Sanitary	50	5	55
	Textile Design	7	6	13
B.M Polytechnic	Mechanical Engineering	60	5	65
	Chemical Engineering	27	5	32
	Civil Engineering	35	5	40
	Electrical Engineering	35	5	40
	Electronic Engineering	30	—	30
	Plastics	27	3	30
K.J Somaiya Polytechnic	Mechanical Engineering	328	2	330
	Civil Engineering	317	3	320
	Electrical Engineering	311	12	323
Bombay Inst. of Tech.	Chemical Engineering	30	—	30
	Environment Tech.	72	4	76
	Diploma Computer Tech.	63	—	63
Shah and Anchor Kutchi	Electronics and Telecommunication	153	5	158
	Fabrication Technology	97	—	97
	Electronics and Radio Engineering	129	5	134
Vivekanand Education Society Polytechnic	Electronic Engineering	168	1	169
	Computer Engineering	168	24	192

Agnel Techni- cal College	Production Engineering Certificate	258	—	258
	Mechanical Draughtsman	16	—	16
	Electrician	16	—	16
	Mechanics of Motor Vehicles	20	—	20
	Fitters	16	—	16
	Turners	16	—	16
	Carpenters	12	—	12
All India Institute of Physical Medicine and Rehabilitation	Prosthetic and Orthopedic Engineering	52	15	67
Government Institutes of Printing Tech- nology	Letter Press and Lithography (full time)	268	—	268
	Letter Press and Litho- graphy (part time)	307	—	307
SASMIRA	Diploma in Man-made Tex- tile Technology	323	—	323
	Diploma in Man-made Tex- tile Chemistry	304	19	323
	Diploma in Man-made Fibre Manufacture Certificate	63	1	64
	Weaving of Man-made fibre fabrics	599	1	600
	Wet Processing of Man- made Textiles	595	5	600
	Man-made Fibre Production	15	—	15
	Dyeing and Finishing of Wool	105	2	107
Government Leather Work- ing School	Artisan Certificate Course in Footwear	30	—	30
	Artisan Certificate Course in Industrial Leather Goods	30	—	30
Bandra School of Art	Interior Design and Decoration (1 year)	20	30	50
	Interior Design and Decoration (2 years)	40	20	60
	Architecture	45	15	60
Academy of Architecture	Architecture	43	22	65
	School of Interior Design	29	15	44
	School of Building Manage- ment	70	—	70
	Textile Design	40	160	200

With all these factors in view, the Regional Vocational Training Institute, Bombay was set-up on 29th August 1977. The objectives of this Institution are:

1. To provide suitable training in basic skills and an Advanced Skill Course in selected trades.
2. Increase women's participation in economic activities by improving their skills and making them employable.
3. Upgrading the skills of the industrial workers.
4. To provide training facilities to women in basic skills, refresher courses and training in selected occupations as per requirement of the industry by arranging short-term courses for them.

The following table gives details about the various training facilities available at the Institute, as per their prospectus.

**Table 4.8**  
**AVAILABILITY AND DURATION OF TRAINING FACILITIES**

Sl. No.	Trade	Duration	No. of Seats per Year
1.	Basic Electronics	2 years	16
2.	Basic Secretarial Practice	1 year	16
3.	Basic Dress Making	1 year	16
4.	Advanced Electronics	6 months	12
5.	Advanced Secretarial Practice	1 year	16
6.	Advanced Dress Making	1 year	12
7.	Instructor's Course	4 months	20

The minimum academic qualification for all the above trades is pass in S.S.C. under the 10+2 system or High School Certificate. It is necessary to pass the respective basic trade in order to be admitted into the advanced trade and to pass both the basic and the advanced trade to be admitted into the Instructor's course.

The basic courses were started in the year 1977. The advanced courses were added to the training programme in the year 1980. The instructor's course known as Principles of Teaching (P.O.T) was introduced in 1981. In addition 3 ad hoc courses were introduced each of one year's duration, but with little success. So far only one ad hoc course of each trade has been completed, the ad hoc Radio and T.V. Course in 1980, the ad hoc Dress Making Course and the ad hoc Secretarial Practice Course both in the



year 1981. Due to lack of response the Advance Secretarial Course was not introduced and an extra batch of the Basic Secretarial Course was started.

### Methodology

The first operative step of the study included listing of all trainees who have been through the RVTI since 1977. This list was obtained from the Institute's office during the month of November 1983. The admission register classifies trainees according to the trades applied for and the year of admission. Information regarding date of birth, marital status, whether belonging to schedule castes, schedule tribes, academic and technical qualifications and industrial experience before joining the VTI is also available. Simultaneously a model questionnaire was also sent to the ISST which was returned with some modifications. The questionnaire consists of four sections. The first section gives information from the application form. The second section gives personal information including present age and marital status, information about family members and income of the household etc. The third section is addressed to those who are either employed or self-employed giving details about the job taken up and the problems faced in self-employment. The last section is addressed to those who are unemployed, covering the various reasons of unemployment.

For implementing the questionnaire, a letter of introduction and a proforma was mailed to the ex-trainees at the addresses obtained from the admission register. The ex-trainees were requested to send back the proforma giving information on name, present address, name and address of place of work (if working), and place and time preferred for an interview. Unfortunately the response level was not very high. The addresses of the ex-trainees were then transferred on to cards and distributed among the investigators. Each investigator was given 8-10 addresses per week which were confined to a particular area such that it minimised travel time.

The classification of the total population was as follows:

Completed forms	169
No response	29
Address not available	22
Questionnaire returned, incomplete	17
Total Population	<hr/> 237

**Table 4.9**  
**DISTRIBUTION OF TOTAL POPULATION**

	<i>No. of Trainees Who Replied</i>	<i>No Response</i>	<i>Changed Address Not Available</i>	<i>Total</i>
In Bombay	158	29	22	209
Outside Bombay	11	17	—	28
Total	169	46	22	237

**Table 4.10**  
**THE TRADE WISE BREAK-UP OF THE POPULATION**

<i>Trade</i>	<i>No. of Successful Candidates</i>	<i>% of Total Sample</i>
Dress Making	108	45.56
Secretarial Practice	77	32.48
Electronics	51	21.51
BDM & BSP*	1	0.42
Total	237	

\*BDM: Basic Dress Making, BSP: Basic Secretarial Practice.

28 of the ex-trainees were residing out of Bombay and only 11 of these had responded with a completed questionnaire.

### **Findings**

The total number of trainees who passed out from the Institute during the period 1977-83 is 237. The above table gives the distribution of the total population.

The dress making trade brings out more successful candidates in comparison to the other trades, 45.56% of the total population being from the dress making faculty. This is followed by secretarial practice (32.48%), then electronics (21.51%). There has been only 1 candidate who has ventured into two vocations.

169 (71.3% of total population) of candidates had been contacted and interviewed. This comprised our sample. About 28.69% of the population did not respond, the reasons being either marriage, change of address or simple disinterest. Our major criterion for classification of the sample was employment status, which was as follows:

Table 4.11

<i>Employment Status</i>	<i>No. of Ex-trainees</i>	<i>% of Total Sample</i>
Employed	94	55.62
Unemployed	56	33.13
Self-employed	19	11.24
Total	169	

Table 4.12

<i>Trade</i>	<i>Employment Status</i>	<i>Employed</i>	<i>Self-employed</i>	<i>Unemployed</i>	<i>Total</i>
Dress Making (DM)		21	19	33	73
Secretarial Practice (SP)		39	—	17	56
Electronics		34	—	5	39
Basic DM & Basic SP		—	—	1	1
Total		94	19	56	169

Employed ex-trainees formed the major part of the sample i.e., 55.62%, followed by 33.13% of the unemployed ex-trainees. The self-employed ex-trainees trailed behind forming a mere 11.24% of the sample.

It would be interesting to observe the distribution of the ex-trainees vis-a-vis their employment status and the trade trained in.

The highest percentage (41.48%) of the employed ex-trainees belonged to the secretarial practice trade followed closely by the electronics trade (36.17%) whereas only 22.34% of the employed belonged to the dress making trade. Majority of the unemployed (58.92%) were from the dress making trade while the ex-trainees from the secretarial practice and electronics trade comprised of 30.35% and 8.92% of the unemployed respectively. Unfortunately no trade other than dress making could offer self-employment to the ex-trainees, 12 of whom have passed the instructor's course.

Looking at the data vocation wise, we find that the electronics trade had the largest number of employed (87.17%) followed by secretarial practice trade with 69.54% employed ex-trainees. Dress making trade was the least successful in providing employment to its ex-trainees, 45.20% of them being

unemployed. 30.35% of the ex-trainees of secretarial practice trade were unemployed whereas only 12.8% of the electronics trade were unemployed.

### **Personal Profile**

*1. Age Distribution:* Nearly half the sample (47.92%) were in the age group 21 – 24 years at the time of conducting interviews. 28.40% of the sample were 25 – 30 years old, 16.56% were in the age group 20 years and less whereas only 7.10% were 30 or more than 30 years old.

*2. Marital Status:* At the time of completion of the project there were 110 unmarried and 57 married ex-trainees forming 65.08% and 33.72% of the sample respectively. Here we may draw an association between marital status and employment status. Out of the 57 married ex-trainees, 35 were unmarried at the time of joining the Institute. If we look more in detail at the above mentioned category, i.e., those who were unmarried before joining but got married subsequently, we find that 48.57% were unemployed, 45.71% were employed and 5.71% were self-employed. Most of the married ex-trainees belonged to the higher income group of Rs. 1,000 and above per month, with the married employed contributing nearly 75% of the total family income. Most of the unemployed married women did not look for a job, the major reason being domestic responsibilities or rearing of young children. Some did not get a job for various reasons while others had to leave the job either because of its being temporary in nature or because of the responsibility of small children.

65.45% of the unmarried ex-trainees were employed, 24.54% were unemployed and 10% were self-employed. Nearly two-thirds of the unmarried employed were supported either by the father or the brother. Only 22% of the unmarried employed were the most important earning members of their families. Hence, it becomes quite evident that employment was not sought among the unmarried solely for monetary purposes.

*3. Academic and Technical Education:* The minimum qualification for admission into the Institute being S.S.C. or Std. X, we found that 60.95% of the sample had passed S.S.C. Only 13.61% had passed their XIth Std. and 16.57% had joined the Institute after completing H.S.C. However, there were only 8 graduates and just one post-graduate from the sample. Unfortunately, the post-graduate ex-trainee was unemployed, as she was quite well off and didn't feel the economic need to take up a

job. 6 of the ex-trainees' qualifications were below the required minimum and hence were admitted into the ad hoc courses. Of these, 4 were unemployed.

4. *Economics* dictated the major reasons for joining the Institute. Obtaining employment was the main factor influencing the ex-trainees to join the Institute. In order of preference some of the other reasons for joining the Institute were:

- (1) Acquisition of skills to be put into use at some time in the future;
- (2) The need to contribute to family finances which could be done by taking up a job-oriented training;
- (3) Availability of spare time and the need to use it constructively;
- (4) Compulsion from the family to undergo training.

In order to understand the whole problem in a better perspective it would be beneficial to analyse the ex-trainees according to their employment status.

It was heartening to know that nearly 56% of the ex-trainees were employed. The great attraction was for government jobs with 67.02% of the employed ex-trainees being employed in various government organisations. Nearly 28% were employed in the private sector, whereas just 5.32% were employed in semi-government organisations.

It was noteworthy that nearly 32% of those employed stated that they secured their jobs through the employment exchange. Here we may draw some connection with the fact that nearly two-thirds of the employed were in the public sector. This point reinforces a comment made by some of the ex-trainees that the employment exchange gave only government jobs. Advertisements also played an important part in securing jobs. Nearly 30% of the employed had secured their jobs through advertisements. In contrast only 5.32% had got their jobs through the RVTI.

A little less than three-fourths of the employed ex-trainees (72.34%) found their training beneficial. Still there were many who said that the work given to them was different from the training they received. The reasons given were that jobs were not available in the trade they were trained for, or when available, the remuneration was low. Also there were quite a few who preferred Government jobs irrespective of its compatibility with the trade trained for. For example, a dress making ex-trainee having done

the instructor's course was employed as a peon in a government organisation. There were only 5 out of 21 of those trained in dress making who had a job in the same trade. The others were either clerks, typists, telephone operators or assemblers. But on the other hand we found the prospects of those trained in secretarial practice or electronics much better.

Almost all of them had jobs compatible with the training they received. Most of the trainees of secretarial practice were either clerks, or steno-typists and those of electronics mostly fitters, mechanics or electronic repairers. There were a few exceptions, as for instance, a secretarial practice ex-trainee was employed as an air hostess and an electronics ex-trainee worked as a milk booth centre manager.

Self-employment being one of the major objectives of the vocational training programme, it is was pathetic to note that only 11.24% of the ex-trainees were self-employed. Another point of concern was that all these ex-trainees were from the dress making trade. Our data showed that nearly 66% of the employed and 75% of the unemployed preferred self-employment. Obviously there were major constraints to self-employment one of them being raising capital for investment. Most of the ex-trainees did not own a unit or a shop but worked at home. The houses being quite small and the average family size being six, the work area was necessarily restricted. A majority of the ex-trainees got their orders from acquaintances or neighbours. Hence, the market for their finished products was very limited. More than half of the ex-trainees (57.89%) stated that they did not get any assistance either from family members or any hired staff.

Monetarily, the self-employed ex-trainees were far down the ladder in comparison to the employed ex-trainees. A majority of the self-employed ex-trainees (73.68%) earned less than Rs.250 per month, their contribution to the total monthly income being just about one-fourth.

From amongst our sample of self-employed there was just one successful ex-trainee. She had opened a government recognised tailoring institute in Nasik. Certificate courses in tailoring, cutting, embroidery and fancy work were conducted at the institute. This apart, there was a course for teachers in tailoring and embroidery. But inspite of it all, according to her, her monthly income did not cross the four-figure mark.

The category of the unemployed ex-trainees formed 33.13% of the sample. The unemployed were further classified into four sub-categories: (i) those who were employed but had to leave, (ii) those who did not look for a job, (iii) those who did not get a job, (iv) those who did not take up employment even after being selected.

32.14% of the currently unemployed ex-trainees had to leave their job, some because they were employed on a temporary basis and others due to personal reasons. Some also stated bad treatment meted out by colleagues and inconvenient place of work as reasons for leaving the job. Domestic responsibility i.e., either marriage or child rearing featured as one of the major personal problems for leaving the job. Nearly 80% of these ex-trainees would like to take up a job again.

33.93% of the unemployed fell into the second sub-category i.e., they did not seek a job. Again, here the major reason was the responsibilities of the household. There were still others, (nearly 37%) who were not able to take up employment because the family members objected to their working. 15.79% of the ex-trainees were unable to look for a job because of health problems.

In the third category there were 30.36% of the unemployed ex-trainees. Various reasons were cited for not securing a job, the main being that the market need for their trade was very limited. All the ex-trainees who had stated this reason belonged to the dress making trade. Most of the other ex-trainees did not qualify for the job either because of being underage or because of not having succeeded in the interview. There were still others who stated that they had failed to secure the job either because preference was given to a graduate applicant or because of the SC/ST reservation policy.

There were just two ex-trainees who did not take up the job inspite of being selected. One had rejected the job because the remuneration offered was very low, the other because she wanted to complete her graduation.

The instructor's course i.e., Principles of Teaching (P.O.T.) being the seniormost course offered by the Institute, we need to look more in detail at the ex-trainees who have been awarded this certificate. Our population being confined upto the year 1983, only 3 courses have been conducted since 1981. The course is of four month's duration. All the P.O.T. ex-trainees were from the

dress making trade with the exception of just one who belonged to the electronics trade.

Among the 30 ex-trainees interviewed, 12 were self-employed, 11 unemployed and 7 employed. The self-employed were all in the tailoring profession. All of them worked in their houses and earned upto Rs. 250 per month. Most of the unemployed had tried for employment but had failed to secure a job, the reasons being limited market need for the trade, preference for graduates etc. The only P.O.T. ex-trainee from the electronics trade was employed as an electronics instructor in a local college. The other employed ex-trainees were employed in different capacities, as a cutter in a Government unit, as typists, as a peon in a government organisation and as a kindergarten teacher. Salaries ranged from Rs. 300/- Rs.1,000 per month. There were almost equal proportions of those who benefitted by the training and those who did not.

Another aspect which will probably throw some light on the problem was the attitude of the instructors. There were about 15 instructors in the Institute, of whom only 4 were women. Two of these took up secretarial practice courses, one was an instructor for dress making course and one was an instructor for principles of teaching course. There was no woman instructor for the electronics trade. The instructors of the dress making trade had reconciled themselves to the fact that it was very difficult for their students to gain employment. They believed that only those who wanted to be self-employed should have learned this trade. They turned a blind eye to the problems involved in securing funds for capital investment by saying that the Institute offered loan facilities which the students did not avail of. On the other hand the students seemed to be ignorant of any such facility offered by the Institute. One suggestion worth mentioning here was that given by an instructor of the dress making trade. He felt very strongly that instead of opening new training centres in the cities it would be more beneficial to open centres of this kind in rural areas where training of local skills could be imparted.

The general complaint of the instructors of the Secretarial Practice Course was that most students were very poor in English, so much so, that they were unable to frame simple sentences. Hence, they felt that the minimum qualification for admissions should be increased from S.S.C. to H.S.C. with proficiency in English. The advanced Secretarial Practice Course



offers telephone and telex operating, working and mechanism of the photostat and duplicating machines. Unfortunately the students did not evince any interest in this course and, hence this course could not be started. The staff of the electronics trade were very satisfied with their ex-trainees as most of them were very well placed in the industry. The Institute possessed many expensive and sophisticated equipments and the students got hands on training without any restriction. In addition, industrial visits were arranged at regular intervals. The Assistant Training Officer in charge of the electronics trade felt that the course should be made more modular. There were about 15 different subjects in electronics course, which could be taught as different optional subjects in the Advanced Electronics Course.

While the majority of the staff were very co-operative, the Assistant Director of Training was very sceptical about the whole project. He did not seem aware of the fact that the evaluation of the working of these Institutes was to be done in two parts, the first part assessing the extent of utilisation/wastage of the training by trainees and the second part dealing with the working of the NVTI and RVTI itself, the second part being taken up by the Ministry of Labour. He opined that each person working on any project should be aware of the aims and objectives otherwise the perspective of the whole study would be lost. He was unable to comprehend in what way we could help to change the syllabus. According to him RVTI was constantly involved in self-evaluation. There was an advisory committee consisting of industrialists, academicians, consultants etc. which met regularly. On the basis of their reports, the needs of the industry and the advances in modern technology, improvements or changes were made in the syllabus from time to time. The Assistant Director chose to ignore that the objective of the Vocational Training Programme was to increase women's participation in economic social development by developing their skills. He was of the firm opinion that the basic objective of the Institute was only to enhance and upgrade the skills of the trainees.

### **Comparisons with the Delhi and Bangalore Studies**

Comparisons between the findings of the three Institutes (at Delhi, Bangalore and Bombay) reveal that the percentage of unemployed ex-trainees is the lowest for the Bombay Institute. While over one-half of the ex-trainees were unemployed in Delhi and Bangalore only 33% belonged to this category in Bombay. The Bombay ex-trainees seemed to be a little more adventurous

(perhaps only marginally) where self-employment was concerned. Around 11% dared to embark on self-employment in Bombay in comparison with less than 7% from Delhi and Bangalore. Lack of support/infrastructural services for sustaining small enterprises was stated to be a major impediment for all the self-employed ex-trainees of the three regions.

Almost all the ex-trainees who failed to find a job attributed their lack of success to the quality of training imparted to them. Hence, it is not possible nor proper to dismiss their reaction as entirely subjective. 80% of the unemployed from Delhi and Bangalore came from families with a monthly income of Rs. 1,000/- and above. Apart from other difficulties in finding suitable employment, there was also a lack of internal pressure for seeking work. The situation in Bombay was not quite the same. Over one-third of the unemployed ex-trainees stated the major reason of their unemployment as domestic responsibility. The second major reason for the unemployed status was the limited market need for their trade. Among the unemployed by trade, there were noticeable variations in the regional pattern. In Delhi 80% of those unemployed were dress makers; whereas in Bombay they formed 59% of the unemployed. The percentage of unemployment for secretarial practice trade varied greatly for the three regions. In Delhi 1.1% of the ex-trainees in secretarial practice trade were unemployed as against 65% in Bangalore and 30.4% in Bombay. Electronics trade proved to be the most successful in providing employment. Over 85% of the ex-trainees of this trade were employed.

A little over two-thirds of the ex-trainees from Delhi and Bangalore who had succeeded in securing a job found the training beneficial. In Bombay 72.3% of the employed attribute their success to the training received. As stated earlier electronics was the most successful from the employment point of view. The ex-trainees of the dress making trade were the ones who got a raw deal. A majority of them were unemployed. Those who have succeeded in getting employed were not satisfied with their jobs – either they were very poorly paid or the nature of their jobs was not compatible with the training they received. This is a strong pointer towards the necessity of relating the trade offered to the pattern of demand. Employment prospects for the ex-trainees of secretarial practice trade are very bright in Delhi and Bombay whereas in Bangalore they do not stand a good chance. Consider-



15. Medical and Ophthalmic Technology	-	42	-	42	-	44	-	42	-	70	-	-
16. Textile and Knitting Technology	-	-	99	2	110	-	108	-	109	-	109	-
17. Food Technology	-	26	-	15	-	30	-	30	-	43	-	-
18. L.G.F.M.	5	-	5	-	5	-	5	-	5	-	5	-
19. Architecture	-	-	-	-	-	-	-	-	45	15	43	22
20. Textile & Dress Making Designing & Fashion Coord.	-	31	-	74	-	83	-	93	37	118	-	62
21. Interior Design and Decoration	-	-	-	-	-	15	-	32	95	97	29	15
22. Commercial and Secretarial Practices	-	44	-	46	-	86	-	86	-	35	-	-
23. Textile Chemistry	-	-	59	2	61	5	62	2	60	6	62	4
24. Fibre Manufacture	-	-	-	-	16	-	15	1	16	-	16	-
25. Pharmacy	-	44	-	41	-	41	-	45	-	45	-	-
Candidate Admitted at Certificate Level	15	-	276	2	285	-	279	1	328	175	474	33
Grand Total of Students Admitted	136	187	757	232	975	312	882	342	3157	726	1691	177
Average Percentage of Successful Candidates	60	65	72	55	70	60	82	46	65	60	62	93

**Note:** Courses like ophthalmic technology, food technology interior design and dress making show high female enrolment figures because the institutions that offer these courses restrict their admission to girls.

ing all the trades, the average monthly income of the employed ex-trainees is around Rs.1,000/-.

### **Conclusion**

Three decades ago the Education Commission had recommended that by 1986, some 20% of all enrolments at the lower secondary level and some 50% beyond class X should be in part-time or full-time vocational and professional courses. A strong effort primarily by the Central Government is needed to encourage boys and girls particularly in the age group 14-18 years to follow vocational and technical courses. A concerted and sustained programme by all Ministries and Departments is needed to interest parents and children in technical work, in vocational courses and in making technical careers attractive. More stress should be laid on informing the public of the needs and possibilities of technical education.

The education system must make vigorous efforts to correct defects in the present training. One of the criticisms is that courses offered by polytechnics tend to be diluted forms of engineering courses. A second is that training is not sufficiently practical or industry-oriented. A third relates to the amount of wastage in students enrolling for courses. Here wastage is to be understood in the sense of students not completing courses or not being sufficiently motivated in utilising the training received in the chosen courses. Various studies have shown that the overall range of wastage rates in diploma courses varies between 35 to 50%.

The Education Commission has made the following major suggestions:

- (1) Periodic investigations should be carried out in co-operation with industry, aimed at job analysis and specifications in terms of levels and clusters of skills and responsibilities for technicians.
- (2) Diploma training should be made more practical by including industrial experience, particularly in the last year of training. A major consequence of this is that the polytechnics should be located only in industrial areas/estates or areas specifically designated for development as industrial locations.

Polytechnics in the rural areas should develop courses allied to agriculture for the craftsmen and technicians needed by agro-industries.

- (3) Particular attention should be given to developing courses of special interest to girls in all polytechnics, for instance careers in commerce, the service trades and industry, interior decoration, electronics and radio technology, commercial art, medical laboratory technology, dress design etc.

There is no doubt that social attitudes inevitably influence occupational choice. But as was evident from our study, the dress making trade accounts for the maximum number of unemployed ex-trainees, amounting to about 60%. Therefore, it is very necessary to introduce an attitudinal change, possibly in the form of vocational counselling, so that girls can be introduced in non-traditional occupations. In fact, this should be an important function of the vocational training institutes. We need to free ourselves from the shackles of "suitable courses/jobs for girls" and venture into all possible fields.

A major objective of the Vocational Training Programme was preparing girls for self-employment, which, unfortunately, has not been achieved by any of the institutes. Imparting training alone is not sufficient, practical experience is a necessary feature of the training. Basic information on banking and credit facilities should be provided as part of the training course to overcome the deficiency of lack of finance. For self-employment to be successful, marketing skills and opportunities play an important role and hence need to be introduced in the training course.

There is a lot which the VTIs can do for the benefit of the students. First of all, a close follow-up should be maintained with the ex-trainees, at least during the first year of their passing out. This would enable them to make necessary changes in the curriculum on the basis of employer reactions. The unemployed could be helped in securing jobs if the institutes could make available to the employers information on the trainees. Advertising regularly in mass media would be of considerable help. Information on vocational training for girls should be made available to girls in secondary schools during their most formative years. This would generate an interest in non-traditional occupations, in which the presence of girls needs to be increased. This would be one step in the direction of changing the status of women in India.

# 5

## In the Frontier Area

### **A Comparative Study of Men and Women in Software\***

The field of computer science is very new, beginning approximately in 1955 with Charles Babbage and his collaborator, Countess Lovelace. The field of computer software, which basically involves instructing the computer to do whatever the human beings want it to, is not more than 25 years old. In India, especially, a lot of consultancy firms have sprung in the past fifteen years and continue to do so.

Though the number of women working in this field is nowhere near the number of men, except for one or two firms, the general impression within the field and outside it too, is that women and men stand an equally good chance of rising in this field. The comparison is with the older more established fields such as teaching, science etc., where the discrimination is perceptible.

Given this widespread belief and the fact that women holding top posts in software industry are a handful only, the aim of this study was to make a comparative appraisal of representative men and women in this field and find out if any differences exist between men and women; and if they do, the possible reasons for this difference.

If differences exist, there could be two major reasons for this; internal, i.e., those related to the psychological orientation of women vis-a-vis their worklife, and external, i.e., those related to the forces that belong to the environment in which the women live and work. Among the first class would be the following – the feeling that homelife should have more priority than a career; holding a job is more to complement the family income than anything else and that worklife is basically a male preserve and the struggle for progress is not worth the rewards.

This is based on a study by K. Jayanathi and P. Madhavan.

Among the external reasons would be — a deliberate downgrading of women employees by the organisation; family and social pressures on the woman to sacrifice career advancement in favour of family life.

Once the issues to be examined had been determined, it was a question of identifying the factors in the workplace which needed to be analysed.

It would be a meaningful exercise at this stage, to give a brief introduction to the existing software industry so that the later analysis of the data collected becomes clearer.

A look at the profile of the people in the software industry by their educational qualification reveals that only graduates enter this field, but the qualifications vary all the way from a three year Bachelor degree in arts, science and commerce to doctorates. For this study, however, the highest qualification has been the seven year Master's degree in engineering & technology or business management. The larger firms generally take a large number of master's degree holders in engineering and technology and a smaller number of bachelor's degree holders. The three year degree holders are taken by the larger firms only under exceptional circumstances and definitely at a lower salary. In all the firms there is a marginal difference in salary at the recruiting stage depending on the qualification. This amounts to not more than 200 rupees for one year of graduate study. Though the promotions and increases in salary generally depend on the performance and not the basic qualification, it would be very difficult for a B.Sc. degree holder (to take an example) to outstrip an M.Tech degree holder.

To understand the type of work done and the positions of the software personnel, we would have to take a look at the way in which, let us say, a payroll system is computerised. First, the existing system is studied to find out its requirements. Then follows the definition and specification of the system as it would exist on the computer. This computer system is further broken up into modules and individual programmes, the programmes being the most basic unit of the computer system. The former activities are done by more skilled persons than the latter, i.e., the system study is done by the most experienced person and the programme writing, by the least. During the development stage, there is generally, at the lowest level, programmers, each handling one or more programmes; then there are co-ordinators, one



or more, to see that the functions of the individual programmes are carried out properly and the schedules at the lowest level met; at the next stage is the project leader who takes care of problems and schedules at the project level and probably liaising with the client too. Beyond that would be managers who handle projects only at the global level. This is of course a theoretical model, and in many smaller firms, especially when the projects are small, all the functions from individual programme handling to project management may be carried out by one person only.

It is necessary to state only a few more facts about the field. Most firms have a lot of business abroad and hence it is inevitable that at least half the people joining this field will go abroad, many in the first year of working itself. Firms also conduct in-house training courses for the new recruits and sponsor employees for outside courses at the later stages. The employee turnover in this field is higher than in other fields.

### **Methodology**

Given the problem, the areas to be examined were:

- (1) Determining whether men and women have different career paths.
- (2) External reasons which may contribute to such a difference, if any.
- (3) Internal reasons as above.

The very nature of the study, which was comparative, made it necessary that an equal number of men and women be taken and their career paths examined.

The factors to be examined regarding the career of men and women were the time taken for promotions, salaries of men and women at the same level, amount of client liaison and the degree of independent command of projects. These gave an idea as to whether or not men and women had different career paths and whether there were any differences between men and women in the same positions.

To determine the external reasons for possible differences, the first factor to be examined was the interest taken by the management in employee development, whether this interest varied with the sex of the employee. The attitude of the family members and the "society" towards the woman's career formed the other side of the external pressure on the woman i.e., whether their attitude was hostile, neutral or encouraging.

To examine the internal reasons, or the internal compulsions of the woman, was more difficult. The conclusions had to be drawn from the statements they made about their other responsibilities, about their priorities and the way in which they handled their career. There was generally a blurring of society's attitude into the woman's own attitude, as most people believe what they have been led to believe. However, even given the circumstances, some women did perceive that there was something wrong when they were expected to run the home too in addition to holding a job while their husbands could concentrate on their careers alone. While the situation itself may not be different, whether the woman ran the home in addition to her career, believing it to be her duty, or did it due to lack of alternatives, the level of awareness would make a difference to the future. At any rate, it was hoped that it would be possible to classify the pressure as internal and external.

To find out the position of women in the industry, it was necessary that their positions be compared to that of men. With this in view, it was decided to choose some of the larger companies, cover all the women and an equivalent number of men through questionnaires to be immediately filled and returned. Earlier, data sheets had been sent to a selected number of companies, 29 in number, to get an idea of the number of women in each and the total strength. As only 7 companies responded, we had to make our own decision regarding which companies to choose for the questionnaire. Accordingly, nine of the larger firms were chosen. One of them (perhaps the second largest in the field) refused to co-operate and we could not manage to contact the employees in any other way. The number of respondents turned out to be 88, much lower than the estimate.

The last question in the questionnaire was whether the respondent would be willing to be interviewed and also take part in the group discussions. Women from only four of the total eight companies responded to this and the contact point for interviews was through this response. Though the study was aimed at both men and women, attitudes and perceptions of women themselves were of importance, so none of the men were interviewed. Part of the reason was also lack of time and resources.

### **Survey Findings**

The statistical analysis of the data collected has been presented in the Appendix in the form of tables. The sample

showed a distinct pyramidal structure regarding age, the number of respondents thinning out rapidly; there was nobody in the 40+ age group and only one woman in the 35-39 age group. This was especially typical of this field.

The educational qualification varies from Bachelor's degree in the arts and science to Master's degree in engineering and business management. There were no doctorates however.

Let us take each of the tables in turn.

### **Age vs. Educational Background (Table 2)**

There was a grouping of women in the 25-29 age group in the M.A./M.Sc./M.Com. degrees while the equivalent grouping for men was in Master's degree in Engineering and Technology. In the younger age group there was no distinct difference. This seemed to show a trend towards women also going in for technical training which was rarer earlier on.

### **Age vs. Current Position (Table 3)**

When the average performers are taken, there was no difference between the men and women. But both exceptionally high performance and exceptionally low performance seemed to come from men. The first was seen by the presence of 3 men in a relatively high post in the 20-24 age group and the second by the fact that there were more men than women in the lowest category in 25-29 age group.

### **Respondents by Years of Experience (Table 4)**

While there was a steady decrease in the number of respondents as the number of years of experience increased, there were more men in the earlier years, or in other words, there were more women with more years of experience.

### **Salary by Age (Table 5)**

There were no glaring differences here though perhaps the boundaries of low salary and high salary were occupied by women and men respectively but there were too many exceptions to draw conclusions. There were men with very low salaries and women with very high salaries, relative to their age.

### **Current Position vs. Salary (Table 6)**

Here there was a distinct tendency for women to be lower paid than the men. For example, in category 2, females formed a majority in the lower salary range of 1501-2000 while males formed a majority in the higher salary range of 2001-2500.

**Salary vs. Years of Experience (Table 7)**

While women do form the lower salary boundary and men form the upper salary boundary, very low earners for their experience were men.

**Attainment of Current Position (Table 8)**

This table gives the current position and the number of years after which this had been reached. The date of promotion, not the current date, had been taken for years of experience. Though in the early stage there was no difference, at the highest level, women reached it after more years of experience; there were no men at all beyond 7 years. However, there were three men with rather low positions for their experience.

**Work done vs. Current Position (Table 9)**

The table shows the type of work done by the men and women at the various positions. The importance of the work (in the table) increased from left to right – coding and testing being the most basic. The only noteworthy feature here was that women seemed to be doing the highest grade work at early stages in their career.

**Subordinates vs. Current Position (Table 10)**

This table shows the number of people working under a person for various designations. This, taken together with Table 9, shows that though some of the people were engaged in higher level of activity, they did not have anybody to delegate the next stage of the work. This meant that all aspects of a particular project were done by the same person. This was indicated in the answers to the questionnaire itself where a number of people had ticked all categories of work at once. There were some people though, in category 2 and 3, who do delegate. This was entirely true in category 4, where these people were probably engaged in project management and system level specification, with the program specification, actual coding/testing etc. done by their subordinates.

**Foreign Assignment vs. Experience (Table 11)**

The number of years of experience were counted from the date of assignment wherever this date is given. There was a distinct difference in the number of men and women sent abroad in the first four years, the figures for men being about double that of women.

**Educational Qualification vs. Selected Areas of Work (Table 12)**

This table shows the sex-wise break-up of persons in the various areas of work within this field, with the educational qualification as an added parameter. There was no significant difference here.

**Training Courses (Table 13)**

This table shows the number of training courses attended and those conducted. Women had attended more courses and conducted more courses too.

**Public Relations (Table 14)**

This table gives the client liaison and presentations made. Men had marginally more client liaison than women but it was not significant enough.

**Concluding Observations**

It can be straightaway seen from the Tables that no blatant discrimination exists in the field. Though men were generally better off regarding qualification, salary and designation, it was a very close race. In earlier stages the differences in salary was due to the differences in educational qualifications. The women entering the field more recently seemed to have qualifications closely resembling that of the men. In the older men and women, there was a distinct difference to show that more men have engineering/technology degrees while more women have arts and science degrees. The sample size was too small to say whether this shows a trend that women have started going into higher degrees in professional fields, but it does point that way.

The progress of women through the various posts followed that of the average men. There was no exceptional career achievement among women, such as that of three men (Table 3) who had reached a fairly high post at a remarkably low age. This was due to the fact that promotions were as dependent on the employees' ability to do what the management wanted, as the ability to do their work well. While there was no indication that women were lacking in the latter, there were definite indications that they were more reluctant to take up foreign posting and even take assignments where they would be required to devote more time to work — this was supported by their answers during the interviews. In the sample taken for the study, there were more women with more years of experience than men. This is due to the fact

that a number of men with larger years of experience were in the higher posts and hence totally out of the picture. But at the same time some awfully bad performances were by men too. For example, there were three men in position 2 with 6 years of experience (Table 8) and there were more men than women in lower categories in both 25-29 and 30-34 age groups (Table 3). It is a good guess that women who have found themselves to be this badly off had quit altogether, while the men have not been able to do this.

Salarywise, the lower salary of women was probably due to, in the first place, their lower qualifications and secondly due to their not getting some of the perks which are given to those persons with dependents to support, which is almost exclusively men. During the interviews, women from one firm did mention that the regulations governing the giving of the house rent allowance made it impossible for married persons to get it without declaring their spouses' income, if any. In practice, however, while men can get away with declaring their wives to be dependent (even when they are not) for women this is impossible. In one other firm, some women did feel there was a salary discrimination between men and women; that their management gave equal salary to women only when the women demand it. While the data did not conclusively support this, there were more women in the lower salary group than men. However, this particular firm had gone through several changes in the management during the one year of the study and no firm pattern of any management policy emerged.

Table 9 throws up an interesting fact. There seems to be more women doing high responsibility jobs in lower positions. This table when read in conjunction with Table 11, shows that more men with lower years of experience had gone abroad than women. It made sense that while the young capable men had been sent abroad, the young capable women were given more responsibilities in the hometown itself. During the interviews, a number of women did stress that they would not be able to go abroad at all, or at least not at such short notice "as men do". This also explains why women attended and conducted more courses than men. While the courses are for employee development and hence all employees would be required to attend, it is also true that presence of employee in the head office is an important factor. Women stayed on in the place of work and men toured more.

One more reason for women doing higher responsibility work at lower positions could be that women generally accept the work given to them, even if it is more than what their position in the hierarchy demands of them. This came out in the interviews, where a lot of women emphasized the general belief that women are more sincere and obedient.

### **Interviews**

The answers were not a definite yes or no in most cases and they were not required to be definite either. The interviews were more to gauge the attitudes of women regarding their profession and their perceptions of this field. Hence only a qualitative analysis was done.

In all, thirty-two women were interviewed. Of these twelve were unmarried and twenty married. Of the married women, twelve had children.

The first part of the interview was regarding the boss-subordinate relationship and whether the sex of the respondent, either as a boss or as a subordinate, made any difference to the relationship. It must be pointed out that not many women had women bosses; only 25% had actual experience, others only voiced their feelings. Most women said that the sex of the boss makes no difference. Only two women, both of whom were working under women bosses said that men made better bosses; while one woman said that it was because men concentrated on the important aspects of the projects and not on trivial details (like the women bosses), the other said men were more considerate. However, six women said there was a better rapport between a woman boss and a woman subordinate. Eleven women said that generally men do not want women subordinates, as they feel that a woman either will not, or cannot, be expected to stay late or overnight when the project is in a crisis; three women felt men underestimate a woman's capacity and hence treat them as less equal than men, but all agreed that this was only an initial feeling. Seven women, however, felt that men think women made better workers due to their sincerity and obedience i.e. women subordinates were more likely to do what they were told and to take more care while doing it than men.

Regarding subordinates, nine women said men had problems working with women bosses (seven with actual experience). None of them felt that the problems disappeared with time. "They (the male subordinates) may stop making irrational

statements, but they do not change their opinion", was the way one woman put it. Four women felt that there was the likelihood of friction between a woman boss and a woman subordinate, mainly due to jealousy on the part of the subordinate. To the question whether they would make allowances for problems which only women have (such as problems connected with staying late or family commitments), only four women answered with an unqualified "yes". Three women qualified by saying that the demands had to be within reasonable limits; the majority felt both men and women have problems, so it would be wrong to make allowances for women only.

The second part was the woman's assessment of her own position in the organisation and in the field; and their commitments and priorities. Eight women felt that they had lost out in age due to their family commitments – all eight of them being married with children. Three women felt they had a low qualification (though many more had the same qualification) which was a handicap, while seven felt their qualifications were different from those in the field. Only five women said they were fully committed to their career – the others said it is definitely within limits. To the question of priority when faced with having to make a choice regarding home life or career, six women said career was their first priority while eleven said home life. The rest were undecided, they said that they would try to manage both. Four of these felt that if there was nobody to take care of the children, they would have to do it, whether they wanted to or not.

The third part was discrimination between men and women. Exactly half the respondents, sixteen in number, said discrimination existed, though all of them said it is more of an unstated, secondary type than any conscious policy of the organisation. Only in one case, that of a government organisation, the women working as part of the staff got three months maternity leave and six weeks for abortion, and the women officers got only six weeks of pregnancy leave and 15 days for abortion. In another firm, perhaps the largest in the field, the married women do not get house rent allowance without declaring their husbands' too, and travel fare for the husband was not provided when the married women were posted abroad; the married men could avail of both. The women said that this was not a policy discrimination as the facilities were available for dependent spouse, which in theory includes husbands and wives, but the management assumes all wives to be dependent and all husbands to be



independent. It must, however, be emphasized that the women's grievance was the management turning a blind eye to many male employees' misuse of the facilities while the women were forced to be honest. A common complaint was that assumptions were made that married women do not want to go abroad, take postings away from the hometown; challenging jobs, which generally means putting in extra hours, are not given to married women. While it was true that a number of women, especially those with children, also stated that they preferred it that way, that they would rather take less responsibility and get less rewards in the workplace than face conflicts and feel unable to cope, many felt the management was not justified in assuming that this would be so for all married women. From this it would be seen that the discrimination was more between married women and others than between men and women. One thing stood out – many women stated that their own organisation did not discriminate, but elsewhere in the field, it did exist.

The fourth and final area was the women's views on future prospects and their plans for coping with conflicts. Only seven women said they expected to reach the top, either in their field or in their organisation, while 20 felt that men had an edge over them; there were no specific reasons given for this – some just pointed to there not being many, or even any women in the highest posts, while others pointed out family commitments and the fact that women derived their sense of success and fulfilment from both home and career and hence they had less drive and determination to succeed in the workplace. The conflicts that women faced were basically that of dividing time between the home and workplace – even for unmarried women, where the duties at home were nil (as was the case in this survey), the attitude of parents was still that of benign tolerance, which changed to hostility if there were too many late nights at work. The women themselves were very grateful for the understanding shown by the parents, in-laws or husbands as the case was and did not expect any more. As stated earlier, only four women said they would have to take care of children whether or not they were willing; the others were willing. The six women who said that they gave more priority to their career did not also state explicitly that they would give up their husbands and children; while the women who put their home life first did explicitly state they would give up their jobs. But in spite of the conflicts they faced and their recognition that some form of discrimination existed, only ten

women said special privileges for women would be desirable, and this, most of them felt, should take the form of escorts or transport home when they had to stay late and nothing more; four felt the management should recognise that women carried a double burden. Only two said job reservation for women was necessary; one on the ground that daughters were educated less than the sons and started their life with a handicap, while the second said a woman had to bring up her family in the early years which were crucial for their career too. The majority of women who did not support job reservation, felt it was an acceptance of lower status. Two felt women would take advantage of the privilege and one said that the hostility from men as a consequence of job reservation made the advantages paltry by comparison.

If we take only the men, women and the management into account, the discrimination was as follows:

1. The granting of certain perks to dependent spouses which in practice turn out to be wives only, as husbands are always assumed to be independent – was seen in one organisation. Thus the women were unable to protest as the rule itself was non-discriminatory while the practice was not.
2. The differential treatment meted out to women officers and women staff in a particular organisation, with regard to maternity and abortion leave.

There was a third accusation that women in a particular organisation were paid less than men unless the women demanded equal pay, but there were as many women denying this as stating it; while the data collected showed that women were marginally less paid, it also showed that they were marginally less qualified. Unless the management had made it a policy to recruit women with lower qualification than men and thus deny them equal opportunity, this cannot be construed as discrimination. And whether such was the case fell outside the scope of the study

The fourth accusation that married women were treated differently from others has as many women blaming the women themselves as the management. There were also a number of women who thought it should be the case; that the management should realise and make allowances for the fact that married women have other responsibilities.

The position of women was very much in the average category. They had not performed as badly as some of the men, the probable reason being that women who had performed very badly dropped out while the men had not been able to do so; neither did the women perform as brilliantly as some of the men, the reason being the women have not been able to satisfy the managements' needs fully, they having to serve two masters, the home and the workplace, as it were.

Thus, we see that only in the light of the role of women in society can we explain the fact that even women who start out promisingly only made average progress at the end of a number of years. As far as the organisations were concerned, they could not be expected to pay special care and attention to the career of the women. If any one organisation did, it would find itself losing out to its competitors and till there was some authority to force the organisations to commit themselves to equal opportunity, they were under no compulsion to do so. The workplace was such that excellence in it could be achieved only by a person who had no other commitments; or at least no conflicting commitments. It was only because the family life revolved around the man, and a man by and large was able to take the family wherever he went that he was able to forge ahead in his chosen vocation, confident that the family would be run by somebody else and will not fall apart in his absence. While many women did realise this, they were not dissatisfied enough with the status quo to want to change it; they were still committed enough to the home to be satisfied with mediocrity in the career, in many cases voluntarily opting for mediocrity (or in other words opting for less responsibilities) so that the home life did not suffer. While most of them admitted that it would be desirable to have men share equally in housework and child care, only a handful said they would demand it of their husband; the rest were content to wait for social change than make demands which would introduce new tensions in their lives. One more reason for the women not to want changes on a global scale was that each thought of herself as an individual and not as part of a group. They shied away from identifying themselves as part of the under-privileged. However, most women did say that if the woman fought hard enough, she could achieve excellence in the field.

While some of the younger women without children stated confidently that they would not compromise in their career, as opposed to the older women who admitted that they had lost out

while taking care of the children, there was no saying if the older women had also been this confident when starting on their career, or whether it really indicated a trend that women were beginning to think of themselves as belonging as much to the workplace as to the home. It seemed unlikely, however, as most women, younger or older, admitted to being more involved in running the homes, including child care, than were their husbands. In fact, it was more child care than housework which restricted a women's mobility. Whatever be the case unless the organisation of the workplace changed to admit and recognise the time and effort spent in the family, a woman was left to fight her individual battle against the existing odds to reach the top. Work at home was not perceived of as being of any value to the woman. A woman's responsibility at home was generally the highest at a young age, which was also crucial to the career. Hence two courses of action were open if women were to be given a better deal in the workplace. Either the men be made equally responsible for housework and child care, thus placing the same handicap on both men and women, or alternatively, women, once they are free of initial child rearing, could be given special training to allow them to catch up. While the first sounds too utopian to be put into practice, the second emphasizes that the responsibility of child rearing is solely that of the woman.

Finally, it is necessary to comment on the initial premises of this survey. Firstly, the hypothesis that the computer field, was too new for age-old prejudices to take concrete forms and thus impede the progress of women; it is a truism that women's position in society, and women's responsibilities at home are the same whether she is in the computer field, or in the older, more established fields. Hence, while the prejudice of the management and colleagues may be a very unpleasant factor in the workplace and part of the reason for a woman's lack of progress, it is her responsibilities as wife and mother that inescapably tie her down in the crucial years of her career. Secondly, we started off by trying to identify separately the internal and external reasons for a woman being handicapped in her profession. It turned out that this distinction was not possible. Most women (as of course most human beings) identify the expectations of them from the society (parents, husbands, children etc.) as their own aspirations. Hence, even if a woman states that she is perfectly happy with mediocre career achievement as long as a happy family atmosphere exists, and believes it too, it is very likely that she would not

believe such a thing if she had not been led to believe that home life is more important for her than career.

### **Comments on the Survey**

This survey has been the first in this field and also the first for the two of us who have conducted it. Hence at the end of the survey, we felt there were several things which should be taken into account when a larger study is undertaken, as this is only a pilot study.

First, in spite of being a comparative study, the emphasis has been on women, to the extent that the selection of men has been done based on the women. That is, not only have organisations with maximum number of women been taken, even within these organisations only men at the same positions, as women have been taken. It is unlikely that an organisation which recruits a lot of women would later discriminate against them — hence the next study should take even those smaller organisations with less number of women. Next, as men in the same posts as women have been taken, the top posts, where no women exist, have been left out altogether. This would also be remedied if men are taken as the normal population.

Secondly, men should also be interviewed to find their attitudes and perceptions — about the field and the women in the field, as well as towards the women close to them.

Thirdly, whenever women are interviewed and allegations of discrimination are made, the policy-makers of that particular organisation can be interviewed and their comments on the allegations solicited.

## APPENDIX

### TABLES

A short explanation of the division of the two categories used in the tables following is necessary.

#### **Educational Qualification**

- Catg. 1 - BSc/BA/BCom or equivalent
- Catg. 2 - BTech/BE or equivalent
- Catg. 3 - MSc/MA/MCom or equivalent
- Catg. 4 - MTech/ME/MBA or equivalent
- Catg. 5 - PhD

Diploma courses have been fitted in the various categories according to the subject and number of years studied.

#### **Current Position**

- Catg. 1 - Programmer
- Catg. 2 - Project Coordinator
- Catg. 3 - Project Leader
- Catg. 4 - Project Manager

**Table 1**  
**RESPONDENTS BY AGE**

<i>Sex</i>		<i>Age</i>	20-24	25-29	30-34	35-39
Male		—	14	22	6	+
Female		—	17	23	5	1
Total		—	31	45	11	1

**Table 2**  
**AGE VS. EDUCATIONAL QUALIFICATION**

<i>Ed. qual</i> \ <i>Age</i>		20-24	25-29	30-34	35-39
Catg. 1	M	3	1	—	—
	F	4	3	1	—
	T	7	4	1	—
Catg. 2	M	5	4	1	—
	F	4	4	—	—
	T	9	8	1	—
Catg. 3	M	3	6	—	—
	F	4	11	2	1
	T	7	17	3	1
Catg. 4	M	3	11	4	—
	F	5	5	2	—
	T	8	16	6	—

**Table 3**  
**AGE VS. CURRENT POSITION**

<i>Position \ Age</i>		20-24	25-29	30-34	35-39
Catg. 1	M	6	9	—	—
	F	13	6	—	—
	T	19	15	—	—
Catg. 2	M	5	9	2	—
	F	4	11	1	—
	T	9	20	3	—
Catg. 3	M	3	4	1	—
	F	—	6	1	—
	T	3	10	2	—
Catg. 4	M	—	—	3	—
	F	—	—	3	1
	T	—	—	6	1

**Table 4**  
**RESPONDENTS BY YEARS OF EXPERIENCE**

<i>Sex \ Exp.</i>	1	2	3	4	5	6	7	8	9	10
Male	15	3	10	6	2	2	1	2	1	—
Female	11	13	5	3	3	5	1	1	—	4
Total	29	16	15	9	5	7	2	3	1	4



**Table 5**  
**AGE VS. SALARY**

Salary \ Age		20-24	25-29	30-34	35-39
1000 to 1500	M	2	—	—	—
	F	5	3	—	—
	T	7	3	—	—
1501 to 2000	M	9	11	1	—
	F	11	9	—	—
	T	20	20	1	—
2001 to 2500	M	2	11	1	—
	F	1	8	1	—
	T	3	19	2	—
2001 to 3000	M	1	—	1	—
	F	—	2	—	—
	T	1	2	1	—
3001 to 3500	M	—	—	2	—
	F	—	1	4	1
	T	—	1	6	1
3501 to 4000	M	—	—	1	—
	F	—	—	—	—
	T	—	—	1	—

**Table 6**  
**CURRENT POSITION VS. SALARY**

Salary	Position	Catg. 1	Catg. 2	Catg. 3	Catg. 4
1000 to 1500	M	2	—	—	—
	F	8	—	—	—
	T	10	—	—	—
1501 to 2000	M	12	7	2	—
	F	9	10	1	—
	T	21	17	3	—
2001 to 2500	M	1	9	4	—
	F	2	5	3	—
	T	3	14	7	—
2501 to 3000	M	—	—	2	—
	F	—	—	2	—
	T	—	—	4	—
3001 to 3500	M	—	—	—	2
	F	—	1	1	4
	T	—	1	1	6
3501 to 4000	M	—	—	—	1
	F	—	—	—	—
	T	—	—	—	1

**Table 7**  
**EXPERIENCE (YRS.) VS. SALARY**

[illegible]

**Table 8**  
**YEARS OF EXPERIENCE\* VS. CURRENT POSITION**

Position \ Exp.		1	2	3	4	5	6	7	8	9	10
Catg. 1	M	14	1	–	–	–	–	–	–	–	–
	F	17	2	–	–	–	–	–	–	–	–
	T	31	3	–	–	–	–	–	–	–	–
Catg. 2	M	4	4	4	1	–	3	–	–	–	–
	F	6	3	3	3	–	–	–	1	–	–
	T	10	7	7	4	–	3	–	1	–	–
Catg. 3	M	–	1	4	2	1	–	–	–	–	–
	F	–	–	–	2	4	–	1	–	–	–
	T	–	1	4	4	5	–	1	–	–	–
Catg. 4	M	–	–	–	–	1	–	2	–	–	–
	F	–	–	–	–	1	–	–	1	1	1
	T	–	–	–	–	2	–	2	1	1	1

\*Date of promotion, not current date, has been taken.

**Table 9**  
**CURRENT POSITION VS. NATURE OF WORK**

<i>Position \ Work</i>		<i>Coding &amp; Testing</i>	<i>Program Design/ Analysis</i>	<i>System Design/ Analysis</i>	<i>Project Management</i>
Catg. 1	M	5	7	3	—
	F	8	6	4	1
	T	13	13	7	1
Catg. 2	M	3	7	5	1
	F	2	7	2	5
	T	5	14	7	6
Catg. 3	M	—	3	1	4
	F	—	1	4	2
	T	—	4	5	6
Catg. 4	M	—	—	—	3
	F	—	—	—	4
	T	—	—	—	7

**Table 10**  
**CURRENT POSITION VS. NUMBER OF SUBORDINATES**

Position Number		Catg. 1	Catg. 2	Catg. 3	Catg. 4
None	M	15	14	4	—
	F	19	11	4	—
	T	34	25	8	—
1–2	M	—	1	1	—
	F	—	3	1	—
	T	—	4	2	—
3–4	M	—	1	—	—
	F	—	1	1	1
	T	—	2	1	1
5–6	M	—	—	—	1
	F	—	1	—	—
	T	—	1	—	1
7–8	M	—	—	2	—
	F	—	—	1	2
	T	—	—	3	2
> 8	M	—	—	1	2
	F	—	—	—	1
	T	—	—	1	3

**Table 11**  
**YEARS OF EXPERIENCE VS. FOREIGN ASSIGNMENT**

<i>Exp.</i>			<i>1-2</i>	<i>3-4</i>	<i>5-6</i>	<i>7-8</i>	<i>&gt; 8</i>
Assignment	Sent	M	4	8	3	1	—
		F	1	4	5	1	1
		T	5	12	8	2	1
	Not sent	M	15	7	1	3	—
		F	22	6	2	1	3
		T	37	13	3	4	3

**Table 12**  
**ED. QUALIFICATIONS VS. SELECTED AREAS OF WORK\***

<i>Ed. Qual</i> <i>Work</i>		<i>Catg. 1</i>	<i>Catg. 2</i>	<i>Catg. 3</i>	<i>Catg. 4</i>
Marketing	M	—	4	2	4
	F	3	1	2	3
	T	3	5	4	7
System Software	M	1	2	4	7
	F	—	4	4	5
	T	1	6	8	12
Operations Research	M	1	—	—	1
	F	1	1	—	—
	T	2	1	—	1

**Table 13**  
**DATA ON TRAINING COURSES**

<i>Courses</i>	<i>Attended</i>						<i>Conducted</i>			
<i>Sex</i>	0	1	2	3	4	5	0	1	2	3
Male	14	13	7	3	2	3	34	3	5	–
Female	12	12	4	6	4	8	31	9	3	3
Total	26	25	11	9	6	11	65	12	8	3

**Table 14**  
**DATA ON CLIENT LIAISON AND PRESENTATIONS MADE**

<i>Sex</i>	<i>Client Liaison Levels</i>				<i>Presentations</i>			
	<i>User</i>	<i>Mgmt</i>	<i>Both</i>	<i>None</i>	<i>0</i>	<i>1-2</i>	<i>3-5</i>	<i>6-10</i>
Male	10	3	15	14	21	11	5	5
Female	7	1	18	20	25	12	5	4
Total	17	4	33	34	46	23	10	9



## AFTERWORD

This book through its set of essays sought to raise some questions pertaining to women's position in science but in the course of answering them or seeking explanations related them to more general issues that concern women and society. The presentation could not be integrated into one explanatory framework that would incorporate all the issues and perforce remains a fragmented picture. Yet some useful trails have been opened that could offer us clues for some of the puzzles and paradoxes.

The data from field studies are rather old. For various reasons they could not be published earlier. They may be "dated" in this sense and some changes in numbers and scale would obviously have occurred in the intervening years. But, the issues they raise or the evidence they give for our presumptions are not "dated". These continue to be with us. A major change deserves to be noted. During the interregnum, the women's movement has gained strength and feminist scholarship on women has attained much greater sophistication.

We began with the questions: Why are there so few women in science? Of the women, who are in science, why do they not do as well as men in terms of winning awards or getting promotions?

The few studies that were presented here were by way of illustrations. They confirm our worst suspicions but also hold out hopes. Women are less represented in science, tending to crowd in the liberal arts. Within science, they tend to converge into a narrow range of disciplines such as biology and chemistry which are more related to immediate applications than physics and mathematics, the more abstract and theoretical branches of science and which for that reason also carry greater intellectual prestige. Once having entered scientific establishments, in general women do not reach the top, (a few may which is more an exception than the rule) despite qualifications and potential. The ray of hope is that more women are entering science and engineering and women are beginning to be more assertive.

The common explanations for the by now fairly well known phenomena of unequal gains for women despite equal access to entry run into two parallel lines—one which says women have to look after their families and therefore any career will be secondary in importance to them; the other seeks an explanation (this is more common in the West) in gender socialisation which sees science as a male activity and therefore women tend to avoid it. The first is really an explanation for why women do not reach the top once having entered. The second accounts for why they do not choose science as a career.

(ii)

We have tried to see in what way "science" is *more* of an impediment to women than other types of careers and reject the psychologistic explanations. The impediment comes not only from women's expected and obligatory roles in the family but also from the structure of scientific organisations which are set up to accommodate only men. The problem is therefore a structural one. "Family responsibility" being obligatory for women takes us to the whole issue of sexual division of labour. This sexual division of labour is a wide ranging device that structures men's and women's position in almost *all* contexts. It operates at many levels and in many complex ways. Its effect is generally negative for women excluding them from positions of power and prestige within the family, society and places of work. It also affects the valuation of men's and women's contributions holding the latter to be less than the former.

To understand its ramifications and its impact one has to analyse how it operates under different modes of production and different class relations. In the earlier pre-capitalist household mode of production, women's child bearing and family care responsibilities did not come in the way of their participation in many productive activities and yet their subordination was ensured through their exclusion from property, from public decision making and through their control by patrilineal family systems that emphasised the pre-eminence of the male as the lineage bearer. The problem area for women has been their interconnection to both production and reproduction, where in the latter their role is greater than that of men. With the organisation of production outside the home, new problems arose for women, but the incorporation of women in "public" production does not abolish subordination of women as Engels assured because Engels did not address the problem of gender relations and organisation of reproduction. He also did not raise the question of differences in procreative functions for women of different classes — heirs for property owners, future workers for the propertyless. We therefore contended that looking at "women and career" and women's inequality we need more than the superficial approach of sex roles. Sex roles are post facto explanations. They offer only a *prima facie* explanation but to understand the *process* by which inequality is created for science-trained women (who are after all a subset of professional women) we must also look at the class relations. Middle-class women are assisted in *entering* science because of the special circumstances that surround them. The growth of a middle-class, the growth opportunities needed by developmental priorities, the impact of earlier social reform movements that emphasised women's education were all powerful influences. While women gained, the gains were limited. The structural condition of sexual division of labour was retained. If we wish to enlarge the range of opportunities for both sexes we have also got to enlarge the range of responsibilities for both. However, the solution cannot be individual.

Individual spouses making adjustments cannot solve the problem. Nor can the problem be looked at in psychological terms of women's lower aspirations, for given the structural conditions, women by balancing career and home are making the most rational choice. Our work structures have to change in ways that would *accommodate* the need for the needs of reproduction, both physical and social. The family and household have also got to be transformed. The rights of men and women to the resources of society must be more balanced. Child care has to be seen as a social responsibility and not that of individual families alone. But this cannot happen in a class society where social reproduction reproduces class relations. In all our field studies, for the middle-class women the pre-occupation is not with housework but child care. The upbringing of children is the most critical element in reproducing class status. The family is involved in the reproduction of social relations of reproduction which in a class society become both class and gender relations. There are new trends. More and more women are "sticking to their jobs" and child care facilities are beginning to be available in the big cities. The marked difference between the West and India that we see is that more Indian women are in science than in the West and are doing fairly well (if not at the top). This can be accounted for by the fact that middle-class women here have kin or domestic servants to ease their work and for the men the wife working outside is a mark of status if it is a status profession and is encouraged *so long as* it does not come in the way of male privileges. It is also encouraged for the extra income that is brought in because it helps to enhance the family's standard of living. This is true for white collar employment in general, but in professions where progress depends on extra time put in, accepting difficult assignments like outstation work, participating in net-works that build the necessary contacts for career progress, women are at a disadvantage. This is the case for science. Added to it is the general feeling that women's primary responsibility is the home and that they should not be "career minded". We wish to ask the counter question, is it good for society and for men to be "career minded" to the detriment of other human values and other human needs? Why is taking care of human beings of less value than dedication to office work which is rewarded so highly?

This brings us to another issue that touches on some fundamental values. What should science be for? Do women want to be doing science if it is for the wrong uses? It is important therefore that they not only take up jobs in science but that they have a say in science policies.

An even more fundamental challenge has come from feminists in the West. They are raising basic questions of the fundamental theoretical premises of science. Why does science have the model of "domina-

tion over nature" as its core inspiration? Why are its models of life or universe one of domination-subordination, of conflict and aggression? In biology, Darwin's model of evolution, in molecular biology, the concept of master molecule, are examples. There are other models in nature which are models of co-operation, models of non-hierarchy and models of self generation which are never incorporated. The feminist scientists attribute this to male socialisation that privileges aggression and competition as values of male-hood and virility. This is a partial view. That science has these models built into it can be also explained as due to the fact that modern science developed in tandem to industrial capitalism. Our new concern for environment is now trying to turn the scientific clock back into less destructive modes. As feminists have documented in the realm of human fertility, patriarchy has made women special targets for experimentation and control. Science has been shaped not only by capitalism but also by patriarchy.

There have been a large number of studies on employed women, especially of the middle-class which usually treat employment as a deviant behaviour and all sorts of connections are sought to be made such as how it affects the children's nutrition, how it affects children's personality, how it affects family relations etc., without regard to many intervening variables. It is not employment *per se* that is a problem. Millions of poor women are employed. It is the connection to production relations that makes a difference. Intellectual work cannot be interrupted; manual work can be. Women traditionally have combined agriculture, spinning, weaving, dairying and hundred other productive activities with child care. Secondly, it is having to be outside the home for several hours that create further problems. Hence women within white collar professions tend to choose those that are relatively less stressful and more flexible like teaching and research as against jobs that are less accommodative to women's needs. We also need to rethink how to reorganise work schedules and work organisations. Thirdly, apart from the compatibility problem is the whole issue of valuation of women's work.

In other words, to focus away from individual women's role conflicts to the structural impediments that bind women, both materially and ideologically is to invite attention to the need for SYSTEMIC CHANGES. It was the social reform movement that paved the way for women's education. We need several similar revolutions in several spheres. The question why are there so few *women* in science cannot be dissociated from why there are so few women in the educated professions as against the majority of men? The problem focus becomes then: that among the privileged, women are less so; among the disadvantaged, women are more so.





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## ABOUT THE AUTHOR

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